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ABSTRACT

This document serves as Volume II of a two-part course designed to improve mathematical proficiency and understanding as the student is given practice in relevant problem-solving situations. It includes the mathematics skills needed to make sound consumer decisions. The purpose of this course is to review, reinforce and extend concepts learned in the Fundamentals of Mathematics course. The focus of this course is on solving consumer-related problems. The use of a calculator is highly encouraged to allow the student to concentrate on the concept, rather than on computation. Volume II of Consumer Mathematics contains computer applications for many of the topics contained in Volume I. The lessons involve using electronic spreadsheets and applying them to real-life situations. The electronic spreadsheets can be used for teaching problem solving as well as for the study and implementation of algorithms. Teachers may choose to integrate these lessons into the corresponding units from Volume I or they may choose to teach the lessons from Volume II after completing Volume I. (Author/PK)

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CONSUMER MATHEMATICS • Vol. II

COMPUTER APPLICATIONS

New York City Board of Education
Division of Curriculum and Instruction
Office of Curriculum Development and Support

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FOREWORD

The Consumer Mathematics Course provides New York City students with an option to meet the New York State Regents Action Plan requirement for a second year of mathematics credit for a local diploma. It is a course which integrates the computer with the teaching of consumer topics. Its purpose is to review and extend the topics from Fundamentals of Mathematics in the context of problem solving. It is hoped that students who complete this course successfully may then continue to take Sequential Mathematics, Course I. Since the applications chosen in the lessons are from real-life experiences, students are provided with a concrete base for learning mathematics.

It is hoped that the integration of the computer will serve as a motivating tool as well as providing students with knowledge of the electronic spreadsheet. The spreadsheet is an integral part of many occupations and thus has many practical purposes.

Each lesson in Consumer Mathematics begins with a clearly stated aim presented in question form. Performance objectives follow; these provide a focus for the teacher. The new vocabulary for the lesson is presented. This is followed by a motivational activity. A full development is presented, with suggested pivotal questions. Applications, solutions to applications and a summary are also included. In each lesson, opportunities have been provided to help students become better problem solvers as well as better consumers. The computer application lessons also include suggestions for lab sessions, homework assignments and homework solutions. A teacher's guide for both Appleworks and VisiCalc have been included to provide guidance to teachers for using particular commands, techniques and functions related to the electronic spreadsheet.

The Consumer Mathematics Course has been designed to anticipate students' needs for making consumer decisions in an increasingly technologically-oriented society. We anticipate that the Consumer Mathematics course will serve the individual needs of your students and enable them to acquire the mathematics skills they need in the present and for the future.

Charlotte Frank

Charlotte Frank
Executive Director
Division of Curriculum and Instruction

ACKNOWLEDGEMENTS

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INTRODUCTION

Consumer Mathematics (Volume I and Volume II) is a course designed to improve mathematical proficiency and understanding as the student is given practice in relevant problem-solving situations. It includes the mathematics skills needed to make sound consumer decisions. The purpose of this course is to review, reinforce and extend concepts learned in the Fundamentals of Mathematics course. The focus of this course is on solving consumer-related problems. The use of a calculator is highly encouraged to allow the student to concentrate on the concept, rather than on computation.

Volume II of Consumer Mathematics contains computer applications for many of the topics contained in Volume I. The lessons involve using Electronic Spreadsheets and applying them to real-life situations. The electronic spreadsheet can be used for teaching problem solving as well as for the study and implementation of algorithms. Teachers may choose to integrate these lessons into the corresponding units from Volume I or they may choose to teach the lessons from Volume II after completing Volume I. This will enable the students to review the topics from Volume I through the computer applications from Volume II.

This curriculum guide is based upon the Scope and Content for Consumer Mathematics. It consists of plans for lessons, which should be considered suggestions rather than prescriptions. The units may be taken in various sequences. This enables schools to make selections of the units to be included for their course based upon their individual population and needs. Each of the plans includes a developmental approach to a topic with a stress on problem-solving. Suggested questions are given to encourage student thinking and involvement in the lesson. The problems presented in the plans are designed to be relevant to students' experiences. The application problems provided with each plan may serve as a resource for teachers so that they may select appropriate problems for their individual classes. Solutions to application problems are given so that teachers may quickly determine students' errors.

It is recommended that basic skills be reviewed cyclically in homework assignments so that the students have the necessary pre-requisite skills needed for each lesson and so that the main focus of the course may be on problem-solving through consumer applications.

CONSUMER MATHEMATICS - COMPUTER APPLICATIONS

VOLUME II

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APPLEWORKS
TEACHER'S GUIDE

The introductory lessons are designed to give students a familiarity with the power of an electronic spreadsheet. We do not aim to make the student proficient in all the material presented. Suggestions for lab sessions are included in each lesson in the event that time is available. The more hands on experience the students have the faster they will master all the techniques presented. Ample practice will be provided throughout the course. Most units include computer applications. In the lessons that follow we will expand on the techniques introduced in the first six lessons. It may sometimes become necessary to refer to these introductory lessons to review a particular function or technique. The use of the Appleworks manual, if available, is also recommended.

The Guide that follows lists the lessons that use the indexed commands, techniques and functions.

Built in Functions:	Introduction	Lesson 2L	Development 3
Average:	Introduction	Lesson 2L	Development 3
	Tables, Charts and Graphs	Lesson 4L	Development 2
Maximum:	Introduction	Lesson 2L	Development 3
	Earning A Living	Lesson 12L	Development 7
Minimum:	Introduction	Lesson 2L	Development 3
Count:	Introduction	Lesson 2L	Development 3
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Sum:	Introduction	Lesson 2L	Development 3
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	Leisure	Lesson 1L	Development 5
	Leisure	Lesson 15L	Development 3,4
	Managing Money	Lesson 5L1	Development 4
	Math in the Home	Lesson 3L	Development 3
	Math in the Home	Lesson 12L	Development 6
Circular Reference:	Introduction	Lesson 5L	Development 3
	Calculators	Lesson 8L	Development 3,6
Clear Sheet:	Tables, Charts and Graphs	Lesson 3L	Development 5
Column Width:	Introduction	Lesson 3L	Development 6
	Managing Money	Lesson 5L1	Development 2

COMMAND:

Arrange:	Introduction	Lesson 2L	Development 10
	Earning a Living	Lesson 12L	Development 7
	Tables, Charts and Graphs	Lesson 3L	Development 1
Blank:	Introduction	Lesson 2L	Development 6
	Leisure	Lesson 1L	Development 5
	Leisure	Lesson 17L	Development 4
	Math in the Home	Lesson 3L	Development 3
	Tables, Charts and Graphs	Lesson 3L	Development 5
Change Filename:	Introduction	Lesson 6L	Development 8
	Earning a Living	Lesson 10L	Development 5
	Earning a Living	Lesson 17L	Development 4
Copy:	Introduction	Lesson 4L	Development 1-6,8
	Calculators	Lesson 2L	Development 2
	Calculators	Lesson 11L	Development 4
	Earning a Living	Lesson 10L	Development 1
	Earning a Living	Lesson 12L	Development 2
	Earning a Living	Lesson 17L	Development 2,3
	Indirect Measurement and Trigonometry	Lesson 8L	Development 3
	Leisure	Lesson 17L	Development 2
	Leisure	Lesson 18L	Development 3
	Managing Money	Lesson 5L1	Development 3
	Managing Money	Lesson 14L	Development 2-4
	Managing Money	Lesson 16L	Development 4
	Math in the Home	Lesson 3L	Development 5,6
	Math in the Home	Lesson 12L	Development 3,4
	Math in the Home	Lesson 19L	Development 2
	Tables, Charts and Graphs	Lesson 3L	Development 2
	Tables, Charts and Graphs	Lesson 4L	Development 2
Delete:	Introduction	Lesson 6L	Development 10
	Earning a Living	Lesson 10L	Development 2,3
	Indirect Measurement and Trigonometry	Lesson 8L	Development 4
	Leisure	Lesson 1L	Development 2
	Math in the Home	Lesson 3L	Development 3
	Tables, Charts and Graphs	Lesson 4L	Development 2
Edit:	Introduction	Lesson 1L	Development 12
	Introduction	Lesson 4L	Development 7
	Managing Money	Lesson 14L	Development 3,6
	Math in the Home	Lesson 3L	Development 1
Find:	Introduction	Lesson 2L	Development 2
Help:	Introduction	Lesson 5L	Development 6

Insert:	Introduction	Lesson 2L	Development 5
	Calculators	Lesson 2L	Development 6
	Earning a Living	Lesson 12L	Development 3
	Earning a Living	Lesson 17L	Development 1
	Managing Money	Lesson 5L1	Development 5
	Tables, Charts and Graphs	Lesson 4L	Development 2
Layout:	Introduction	Lesson 3L	Development 2,3
	Earning a Living	Lesson 6L	Development 3
	Leisure	Lesson 17L	Development 2
	Managing Money	Lesson 5L1	Development 2
	Math in the Home	Lesson 19L	Development 2,3
	Tables, Charts and Graphs	Lesson 3L	Development 2,3
	Tables, Charts and Graphs	Lesson 4L	Development 2
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	Leisure	Lesson 1L	Development 5
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	Calculators	Lesson 2L	Development 9
	Leisure	Lesson 1L	Development 6
	Leisure	Lesson 18L	Development 7
	Managing Money	Lesson 16L	Development 6
	Tables, Charts and Graphs	Lesson 3L	Development 4
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	Managing Money	Lesson 5L1	Development 6
	Managing Money	Lesson 5L2	Development 7
Save:	Introduction	Lesson 1L	Development 1
	Indirect Measurement and Trigonometry	Lesson 8L	Development 3
	Leisure	Lesson 1L	Development 2
	Managing Money	Lesson 5L1	Development 7
	Managing Money	Lesson 14L	Development 7
	Math in the Home	Lesson 3L	Development 3
	Math in the Home	Lesson 19L	Development 5
Standard Values:	Introduction	Lesson 3L	Development 4,5
	Calculators	Lesson 2L	Development 7
	Leisure	Lesson 18L	Development 6
	Managing Money	Lesson 5L1	Development 6
	Managing Money	Lesson 5L2	Development 3
	Managing Money	Lesson 14L	Development 7
	Managing Money	Lesson 16L	Development 5
	Math in the Home	Lesson 12L	Development 5
Titles:	Introduction	Lesson 5L	Development 1
	Earning a Living	Lesson 6L	Development 1-3
	Tables, Charts and Graphs	Lesson 3L	Development 6
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	Math in the Home	Lesson 19L	Development 7,8

Delete Files:			
From Desktop	Introduction	Lesson 2L	Development 7
From Disk	Introduction	Lesson 6L	Development 10
	Earning a Living	Lesson 10L	Development 3
Error:	Introduction	Lesson 3L	Development 10
Filenames:	Introduction	Lesson 1L	Development 1
Forward Reference:	Introduction	Lesson 5L	Development 3
	Calculators	Lesson 8L	Development 3
Initializing Diskettes:	Introduction	Lesson 6L	Development 1,2
Label Formats:	Introduction	Lesson 3L	Development 2
	Tables, Charts and Graphs	Lesson 4L	Development 1
Load Files:	Introduction	Lesson 2L	Development 1
	Earning a Living	Lesson 10L	Development 2
	Earning a Living	Lesson 17L	Development 1
	Leisure	Lesson 1L	Development 3
	Managing Money	Lesson 16L	Development 2
	Tables, Charts and Graphs	Lesson 4L	Development 2
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Pointers:	Calculators	Lesson 11L	Development 3
	Managing Money	Lesson 5L1	Development 3
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Rounding Values:	Calculators	Lesson 2L	Development 5
	Earning a Living	Lesson 10L	Development 6,7
	Tables, Charts and Graphs	Lesson 4L	Development 2
Recalculation:	Introduction	Lesson 3L	Development 7
	Tables, Charts and Graphs	Lesson 4L	Development 4
Repeating Label:	Calculators	Lesson 2L	Development 8
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	Managing Money	Lesson 5L1	Development 5
	Managing Money	Lesson 14L	Development 5
	Math in the Home	Lesson 3L	Development 2
	Managing Money	Lesson 12L	Development 2
	Tables, Charts and Graphs	Lesson 3L	Development 2

Sorting:	See COMMAND, Arrange		
Special Cursors:	Introduction	Lesson 1L	Development 12
Spreadsheet Size:	Introduction	Lesson 1L	Development 1
Text Screen Dump:	Introduction	Lesson 6L	Development 9
Value Formats:	Introduction	Lesson 3L	Development 3,4
	Math in the Home	Lesson 19L	Development 3
	Tables, Charts and Graphs	Lesson 3L	Development 1

CONSUMER MATHEMATICS

Introduction to the electronic spreadsheet (Appleworks)

LESSON: 1L

AIM: What is an electronic spreadsheet?
Who uses these spreadsheets and how are they used?

PERFORMANCE OBJECTIVES: The student will be able to...

1. Recognize the spreadsheet.
2. Become familiar with its uses.
3. Use the computer to access Appleworks:
    a) Understand all the options.
    b) Choose the correct option.
4. Develop skill in:
    a) Selecting legal file names.
    b) Moving the cursor.
        1) By entries.
        2) By pages.
    c) Entering data.
    d) Differentiating between a label and a value.
    e) Recognizing various parts of the spreadsheet.
5. Correct mistakes in typing.
6. Edit entries.
    a) Toggling between change and insert modes.
    b) Recognizing the different cursors of Appleworks.
7. Save the worksheet.

VOCABULARY: electronic spreadsheet, character, data, file, cursor, coordinate, cell, mode, inverse mode, insert mode, change mode

MOTIVATION:

Are there faster ways of manipulating numbers then using the calculator?

- A calculator will find the square root of a number very quickly but it will take twenty-five times as long to find the square root of twenty five numbers.

- If we wish to find the area of one rectangle we can find the answer quickly using a calculator, but if a problem arises where we need to find the area of 100 rectangles then we may choose to use a computer.
- Writing a program to solve these problems requires the knowledge of a computer language.
- Programmers have greatly simplified our lives by writing programs for us that are simple to learn and easy to use. These programs are called electronic spreadsheets and are marketed under several names.
- In this course we are going to be learning Appleworks.

DEVELOPMENT:

1. Teacher distributes handout of spreadsheet. A replica can be drawn on the board or the computer can be used as a demonstrator. Pertinent parts of the worksheet are pointed out, explained and discussed.
    a) The meaning of column (named by letters), row (named by a number), and cell (named by a letter first and then a number).
    b) The size of the spreadsheet. A...DW, have students calculate, A...Z + AA...AZ + BA...BZ + CA...CZ + DA...DW = 104 + 23 = 127. Hence the spreadsheet has 127 columns. If we combine this with the 999 rows we get 127 x 999 = 126,873 cells.
    c) Explain that information placed on this sheet is called data. When the sheet is completed and ready to be saved we call it a file. If a teacher wanted to use this sheet as a marking book she could enter the names of 999 students (not exactly a recommended class size). If two columns were used for the first and last name then there would be enough room left for 125 grades for each student. Lead students to understand that only small portions of the worksheet are used when creating a file.
2. A list of uses for the spreadsheet should be elicited and developed.

PERSON USING THE SPREADSHEET	WHAT THE SPREADSHEET IS USED FOR
Teachers	Save student grades and calculate student averages.
Students	Save all grades in all subjects and calculate averages.
Cooks	Adjust recipe ingredients.
Employers	Calculate employee salary.
Employees	Calculate income taxes.
Merchants	Determine selling price based on cost, percent of profit and sales tax.
Salesmen	Calculate commission.
Clubs	Keep track of membership dues and expenses.
Sports	Calculate batting averages.
Real Estate	Project future housing and mortgage costs.

3. The students should now be ready to enter the Appleworks spreadsheet.
   a) Have them put the disk in the drive and turn the computer on. Point to the section that asks for the date. Have students enter date and discuss how Appleworks accepts many different ways of entering the date but displays a specific date format. Stress the use of the return key to signal the computer that we are finished with our entry.
   b) The student should now see the MAIN MENU displayed on the screen. If the MENU is not there the date should be reentered and the RETURN key should be pressed.
4. Understanding the MAIN MENU and its options:
   a) Option 1: Add files to the desktop. This is the option that we are going to use. It will permit us to create a worksheet of our own.
   b) Option 2: Work with one of the files on the desktop. If we had written a file earlier in the period then it would still be around and we could choose to work with that one instead of creating a new one.

c) Option 3: Save desktop files to disk. This is how we are going to save all the files that we create.

d) Option 4: Remove files from the desktop. When files are very old and we no longer need them, we will use this option.

e) Option 5: Other Activities. This option will be discussed in a later lesson.

f) Option 6: Quit. This option puts us back in APPLESOFT BASIC.

g) On the bottom of the sheet we see: Type number, or use arrows, then press return_. Teach the two cursors at this point. The large cursor that puts the option into inverse mode can be moved up and down the MENU using the up and down arrow keys. Have students practice this technique. Inform students that this is one method of selecting an option. The other method uses the second cursor. Point out the small dash after the word return on the bottom line. Inform students that this is a second cursor. If the number of the desired option is pressed, it will take the place of this cursor and the cursor will advance one position to the right. Thus there are two ways of choosing an option. Either place the large inverse cursor over the desired choice and then press return or type the number of the desired option and then press return.

h) The (inverse A - ? for HELP) in the lower right corner is a technique for gaining assistance that we shall discuss further in another lesson.

i) Have students select OPTION 1 and view the ADD FILES MENU.

5. Point to the top right corner. Escape: MAIN MENU. Tell students if they press escape they will be returned to the MAIN MENU. Let them try this and then reenter the ADD FILES MENU using the two different techniques previously discussed. Toggling back and forth builds student confidence.

   GET FILES FROM: explain the five options that follow.

   a) Option 1: the current disk: Drive 2. If we wished to load a previously saved file and the DATA DISK on which the file was saved was currently in DISK DRIVE 2, we would choose this option.

b) Option 2: a different disk: This option permits us to change the drive where our DATA DISK is stored.

c) Make a new file for the : 3. WORD PROCESSOR, 4. DATA BASE, 5. SPREADSHEET. These options permit us to use all the many parts of APPLEWORKS. In this course we will use only the Spreadsheet. Have students select option 5.

6. This third menu is called the SPREADSHEET MENU. By pressing the escape key this time you return to the ADD FILES MENU. This very handy feature helps us quickly correct errors in the event we choose the wrong option. In this menu we are only going to be concerned with Option 1. MAKE A NEW FILE: 1. From scratch. The other two options, the DIF(TM) and VISICALC(R) files are for advanced users and not covered in this course. Choose Option 1 and see the APPLEWORKS CURSOR on the bottom line prompting the user for a FILENAME.

7. Selecting a filename. We want to choose filenames that are in keeping with the type of file that we are saving. The reason for this is obvious. If we forget in a month or two, what we did today, the filename will tend to remind us. If I were saving a recipe for chocolate cake I wouldn't call it apple pie! All filenames must have a maximum of 15 characters, they must begin with a letter and if you include a space it must be counted as a character. Have students practice finding legal file names. No character other than a letter, a number, a space, or the period are permitted in a filename.

8. After the filename is entered and the student presses return the spreadsheet should appear. Point to the large white cursor in cell A1 and teach students how to move this cursor. The four arrow keys are used for down, up, right, and left. To advance the cursor a page at a time the OPEN APPLE key is used in conjunction with the arrow. These two keys must be pressed simultaneously to advance

the cursor a page at a time. Scrolling to the ends of the sheet is a good way to impress students with the size of the spreadsheet.

9. Now we may begin entering data. Have students enter their subjects and several grades for each subject. The first time this is attempted by the student it is suggested that the class all enter the same data. (See applications for suggested worksheet.) After this lesson lab sessions can be provided where the student is given time to experiment with his own data. There are two ways of signalling the APPLEWORKS program that you have completed entering all the data that you wish in a particular cell.

- Pressing the return key is all that is needed. The cursor remains ove the data just entered and to advance to the next cell you simply press one of the arrows, depending on the direction that you intend to move the cursor.
- You can save a little time by doing two things at once. You can enter the data and advance the cursor all at the same time by not pressing the return key but simply pressing the arrow that indicated the required direction of movement.
- For example: GRADE,RETURN, accomplishes the same as GRADE, .

    a) Differentiating between a value and a label. If an entry begins with a letter it is classified as a label. If an entry begins with a number, a + or - key, or a decimal point, it is classified as a value. Appleworks makes this distinction because numeric operations can only be performed on values. There are some keys that will cause APPLEWORKS to "honk". This rather unpleasant sound is a signal to you from the program that the key you have just pressed has no meaning at this point. Just as a test try pressing the question mark or the explanation point. That sound tells you that the spreadsheet program is looking for either a value or a label and the key you just pressed cannot be the beginning character of either.

10. To see how Appleworks learns and remembers direct sutdent attention the the three bottom lines.
    a) The top line is called the cell indicator line. You will see that you can read the coordinates of the cursor's present location on that line. If the cursor is covering a blank cell say B6 then "B6" will appear on the cell indicator line. If there is data in B6 such as GRADE, then B6 (label) GRADE will appear on this line. What will appear on the cell indicator line if the cursor is over H68 which contains the data 100?
    b) The middle line is called the EDIT/ENTRY line. As we type in our data it appears on this line. When we edit our data it appears on this line as well.
    c) The bottom line gives us directions as we go along. I call it the COMMAND LINE. Its use will become clearer as we develop skill in the use of this program.

11. The use of special keys is vital to the ease of using this program. If an error occurs while entering data we cannot backup with the left arrow. Remember the arrow is used to move the cursor. As soon as the arrow is pressed the APPLEWORKS PROGRAM enters the data and advances one cell in the direction of the arrow. To correct these errors we use the DELETE key. By pressing the DELETE key we erase the character directly to the left of the cursor. Have students practice this technique. Pressing the OPEN APPLE in connection with other keys permits us to enter the different APPLEWORKS COMMANDS. We will learn more about this later. If we find that we are in an incorrect command or have accidently accessed the wrong menu we can return to our original position by pressing the ESCAPE key.

12. It is necessary to know how to correct mistakes after the data has been entered. This is the EDIT COMMAND and we access this command by pressing the U key in conjunction with the OPEN APPLE key. All editing is accomplished on the EDIT/ENTRY line, the middle of the three bottom lines. They are called INSERT MODE and CHANGE MODE.

a) You can tell the current typing mode by the appearance of the cursor. If the cursor looks like the familiar dash that we have been using so far "_" we say we are in INSERT MODE. This is the safest mode to type in because it prevents us from erasing valuable data. It does exactly what it promises by its name, it inserts letters wherever you want them. (That is before or after a word or somewhere in the interior.) It takes a while to become familiar with this method but once you get used to using INSERT MODE you will be very happy with this added feature of APPLEWORKS. You position the cursor over the character immediately to the right of the one you wish to insert. For examply let us say you typed "jup" instead of "jump". To place the m in the interior of the word "jup" position the cursor over the "p" and type the "m".

b) The second mode is called CHANGE MODE and is accessed by pressing the E key in conjunction with the OPEN APPLE. The appearance of the cursor changes. It now appears as a solid square. This mode does exactly what it says it does. When editing an entry it will change the letter at the present cursor location on the edit line and it will not be necessary for you to use the delete key. For example: You type "Manday" but you meant "Monday". Place the cursor over the first "a" and type "o".

c) You can return to INSERT MODE by pressing "OPEN APPLE-E" again. Students should be given time to practice toggling between insert and change modes as well as identifying what typing mode they are in by recognizing the cursor. While insert mode is recommended for entering data, change mode is recommended for editing data.

13. After the suggested file has been entered the student should be given an opportunity to save his work so that it can be recalled at subsequent lessons. We save a worksheet by typing the S key in conjunction with the

Open APPLE. As soon as this is accomplished the worksheet disappears from view and the program informs you that it is carefully saving the MYGRADE file in the drive that you specified contains the data disk. (Teacher should make sure tht this was done correctly at the beginning of the session. This should be done without raising to much student curiosity. Ample time will be devoted to this procedure at a subsequent lesson.)

APPLICATIONS:

1. Suggested Worksheet:

MY GRADES

SUBJECT	TEST 1	TEST 2	TEST 3	TEST 4	TEST 5	TEST 6
ENGLISH	90	85	87	90	90	95
HISTORY	90	85	91	95	90	95
HYGIENE	95	89	90	92	100	10
MATH	65	65	65	72	80	95
MUSIC	80	80	75	85	80	85
SCIENCE	67	65	70	72	78	88
SPANISH	72	75	70	80	80	90
TYPING	99	100	100	100	100	100

2. Several values as well as labels should be changed with the edit keys.

3. Practice using the delete key to correct errors while entering data.

4. Practice determining when to use insert mode and when to use change mode.

- What edit mode are we in if the cursor looks like this "_"? (insert)
- What edit mode should be used to change the entry "80" to "90"? (change)
- What edit mode should be used to change "comission" to "commission"? (insert)

SUGGESTIONS FOR LAB SESSIONS:

Make work sheets to display:

a) Names and Phone Numbers.
b) Inventory: Item name, number, cost, quantity on hand.
c) Table of students' (or ideal) heights and/or weights.
d) Distance in miles between major cities.
e) Household Budget to include the months of the year and income as well as expenses.

SUMMARY:

1. What is the size of the Appleworks Spreadsheet?
2. Could an electronic spreadsheet be used to keep track of operating room schedule? Explain?
3. Explain what Appleworks means when it refers to the desktop.
4. What option would be used when you wish to start a new file? Load a file from a disk?
5. Can a filename begin with a number? Can it contain a #?
6. Can a label begin with a number? (Yes, if preceded by a ": This will be covered in the next lesson.)
7. What information is found on the top line of the three bottom lines?
8. Name the cell that is located by the fifth row and the B column?
9. When naming the coordinates of a cell do we name the row or the column first? Does it matter?
10. How many characters are in the filename MY GRADES?

HOMEWORK:

1. Select the legal file names, give reasons if not acceptable.
   a) Grades.
   b) My Friends.
   c) (Phone list).

d) PHONE NUMBER LIST.
e) 365 day calendar.
f) Fifty %.

2. From the following list choose the values, the labels or indicate "neither".
   a) Sam
   b) +13
   c) (90)
   d) **A**
   e) 39.98

3. Describe what happens to the cursor when the arrows are used in conjunction with the open apple key?

4. Explain how the cursor on the body of the spreadsheet differs from the cursor on the bottom three lines?

5. What key is used to correct a character while entering data?

HOMEWORK SOLUTIONS:

1. a), b), Legal.
   c) Begins with an incorrect character, must begin with a letter and cannot contain left or right parentheses.
   d) Contains 17 characters, 15 is the maximum.
   e) Begins with a number, must be a letter.
   f) Contains a character other than a number or a letter.

2. a) Is a label.
   b), c), and e), are values.
   d) Is neither.

3. It will advance the cursor one page in the direction to the arrow used.

4. The main cursor is a large inverse bar that covers the width of one column and passes over the data in the spreadsheet. It is controlled by the arrow keys. The cursor on the bottom lines can be a small dash _ indicating insert mode or a solid square, indicating change mode.

5. The DELETE key.

SAMPLE   APPLEWORKS SPREADSHEET

```
FILE:(PUT FILENAME HERE)      REVIEW/ADD/CHANGE        ESCAPE:  MAIN MENU
=======A====B====C====D====E====F====G====H====I====J====K====L====M====N==...DW
    1
    2
    3
    4
    5
    6
    7
    8
    9
   10
   11
   12
   13
   14
   15
   16
   17
   18
   19
   20
   21
   22
   23
   24
   25
   26
   27
   .
   .
   .
  999
--------------------------------------------------------------------------------
CELL INDICTOR
EDIT/ENTRY
TYPE ENTRY OR USE A COMMANDS
```

CONSUMER MATHEMATICS

Introduction to the electronic spreadsheet (Appleworks)

LESSON: 2L

AIM: How is the electronic spreadsheet used to retrieve and manipulate our data?

- What are some of Appleworks built in functions and how can we access them?

PERFORMANCE OBJECTIVES: The student will be able to...

1. Use the Appleworks catalog to retrieve previously saved data.
2. Use the COORDINATES option of the FIND COMMAND to jump the cursor to a given position.
3. Use the cursor as a pointer.
4. Become familiar with the use of the built in Appleworks Functions:
   a) Sum
   b) Minimum
   c) Maximum
   d) Average
   e) Count
5. Remove data from the spreadsheet by using the:
   a) BLANK COMMAND.
   b) DELETE COMMAND.
   c) Option 4 of the MAIN MENU: Remove files from the desktop.
6. Use the INSERT COMMAND to insert a new:
   a) Column
   b) Row
   c) Block of data.
7. Sort using the ARRANGE COMMAND to place data:
   a) In numerical order.
   b) In alphabetical order.

VOCABULARY: pointer, sort, built in function, delete, block of data, alphanumeric

MOTIVATION:

Where is the worksheet that we saved yesterday?

- How can we access it today?
- Is there a fast way of sending the cursor to a given coordinate?
- What are some of the ways that Appleworks manipulates data?

DEVELOPMENT:

1. This lesson should begin by loading the MYGRADES file. The Appleworks program disk must be loaded into the computer. After the student enters the current date the Main Menu is displayed. This will be familiar to the student. A data disk must be available on which the MYGRADES file was previously saved. The placement of this disk depends on whether you are using a one or two drive computer.
   a) One drive computer. Choose option 1 of the Main Menu. (Add files to the desktop.) This brings up the Get Files Menu. Check to see what drive is specified as the current drive. If it is Drive 1 then select option 1, "the current drive". If on the other hand the wrong drive is specified, select option 2. (A different disk.) This will cause the "Change Current Disk Menu" to be displayed. The options are:
      1) Drive 1.
      2) Drive 2.
      3) ProFile or other ProDOS directory.

      Choose option 1, indicating Drive 1. After you press return you will see the Add Files Menu displayed again but now the current disk drive is 1, the correct one. Select option 1, (the current disk drive) and an empty menu labeled Appleworks Files will be displayed. On the bottom of this menu you will see Appleworks prompting you to remove the Appleworks program disk and to insert the data disk in drive 1. Follow the instructions that appear on the bottom of this menu. You will be asked to toggle between these two disks several times until the data that is contained on the data disk is displayed on the computer.

b) Two drive computer. Choose option 1 of the Main Menu. (Add files to the desktop.) This brings up the Get Files Menu. Check to see what drive is specified as the current drive. If it is Deive 2 then select option 1, "the current drive". If on the other hand the wrong drive is specified, select option 2. (A different disk.) This will cause the "Change Current Disk Menu" to be displayed. The options are:

1) Drive 1.
2) Drive 2.
3) ProFile or other ProDOS directory.

Choose option 2, indicating Drive 2. After you press return you will see the Add Files Menu displayed again but now the current disk drive is 2, the correct one. Select option 1, (the current disk drive). This will cause the Appleworks Files Menu to be displayed.

c) The Appleworks File Menu contains information on disk volume that should not concern the student at this time. Discuss the following display:

NAME	TYPE OF FILE	SIZE	DATE	TIME
MYGRADES	Spreadsheet	2K	9/9/85	

Explain to students that their MYGRADES file will remain on the disk, exactly as it was saved, unless they choose to alter it. Point out that Word Processor and Data Base files are saved on the same disk. Read the directions on the bottom and use the right and left arrows as they suggest. Files can still be accessed by using the return key. Tell students that the process of retrieving these files is called "loading a file". Load the MYGRADES file. Stress that loading the file from the disk does not remove it from the disk. Alterations can be made, but only under their control.

d) Review the meaning of "desktop". Have students understand that the desktop refers to the current computer memory. Up to twelve files can occupy the desktop before the computer runs out of memory. The MYGRADES file is now in two places. On the desktop and on the floppy disk that is in the disk drive.

2. When the file is initially loaded the position of the cursor is exactly where it was when the file was saved. Tell students there is an easy way of jumping the cursor to a given coordinate. This is done with the FIND COMMAND. Press the Open Apple in conjunction with the "F" key (OPEN APPLE-F). The display on the bottom line will be:
   (Find? Repeat Last Coordinates Text)
   The cursor will be over "Repeat Last". Use the right arrow key to move the cursor to the Coordinates option and press return. The bottom line now displays the term Coordinates? The cursor will jump to what ever coordinate you specify at this time. Practice jumping the cursor across the spreadsheet. Notice how Appleworks retains the coordinates of the last location specified. This would be a good time to review the different editing modes.

3. One very special feature of Appleworks is the built in functions. The people that wrote the Appleworks program taught it how to find the SUM of a group of numbers. How to find the AVERAGE, the MINIMUM number, the MAXIMUM number and how to COUNT non zero numbers. The way we access these built in functions is with the "@" key. As soon as the program sees that key, it knows we are going to request a built in function. First we must position our cursor in the cell where we want our answer to appear. Let us find the sum of the ENGLISH grades. To send our cursor to H3 we use the FIND command. Now that our cursor is over H3 we type "@SUM(B3.G3). This will give us the sum of the grades in row 3 beginning in

column B and ending in column G. Our answer will be placed in column H. To find the AVERAGE of the HISTORY grades, place the cursor over H4 and type "@AVG(B4.G4)" and the answer will appear in H4. To find the MAXIMUM HYGIENE grade, position the cursor at H5 and type "@MAX(B5.G5)" and 100 will appear in cell H5. To find the MINIMUM MATH grade, position the cursor over H6 and type "@MIN(B6.G6) and 65 will appear in H6. To count the number of SCIENCE grades, position the cursor over H7 and type "@COUNT(B7.G7) and 6 will appear in H7.

4. Suggest to students that they find the average or the maximum grade for all subjects. Lead them to see that the H column, that they just created, cannot be labeled as there are so many different functions represented. Show them the way to delete the data from that column by introducing the DELETE command. First position the cursor anywhere within the column that you wish to delete. Press "Open Apple-D". The words (Delete? Rows Columns) appears on the bottom line with the cursor over the word "Rows". Since we wish to delete a column we use the right arrow key to position the cursor over the word "Column" and then press return. The entire column that contained the cursor has been transformed into inverse mode. The message on the bottom line tells us to "use cursor moves to highlight columns, then press return". Have students highlight various columns using the left and right arrow keys. Explain that when the return key is pressed all of the highlighted columns will be deleted. Have students delete only the H column. In the event that errors were made and some students deleted too much, they can retrieve their original file from the disk as they did at the beginning of the period. If time permits rows can be deleted as a general practice and the original worksheet can be loaded again.

5. The INSERT command is very similar to the DELETE command. This command inserts rows or columns at the current position of the cursor. It is accessed with "Open Apple-I". The bottom line asks for rows or columns. This time

after you press return you are asked to specify a number. You can give it any digit, up to a maximum of 9 inserts. After pressing return the specified number of rows or columns are inserted and the data after the insert is moved. If we insert 3 columns when the cursor is in column R then the R column and all columns to the right of the R column are moved 3 columns to the right. The R, S, and T columns are empty. If we insert 5 rows when the cursor is in row 20 then row 20, 21,22, 23, and 24 are emptied and all rows below and including 20 are moved down 5 rows.

6. The BLANK command can also be used to erase data. It is accessed with "OPEN APPLE-B". The bottom line prompts the user:
   (Blank? Entry Rows Columns Block).
   If you choose "Entry", the data in the current cursor position will be erased. If you choose "Rows" you are asked to move the up and down arrow keys to highlight the area you wish to erase. If you choose "Columns", the right and left arrows can be used to highlight the columns you wish to erase. If you choose "Block", all four arrows can be moved to highlight a section of data that you wish to erase. With the block option the sections that you choose to erase need not be complete rows and columns. The cursor highlights entires only as it moves as opposed to complete rows and columns.

7. When you choose to erase the complete file from the screen you can do this with the "Remove Files from the Desktop" (Option 4) of the MAIN MENU. When this option is selected you are asked if you wish to save the file on the current disk, a new disk, or throw away current changes. We wish to throw away the current changes and thus clear the entire worksheet. After choosing option 3 (throw away current changes) pressing Return, and answering "yes" to "Do you really want to do this?", you have cleared the desktop. There are no longer any files on the desktop. To continue you will have to create a new file or reload the old file.

8. The Appleworks cursor can be used as a pointer. This may not sound very appealing at first but most experienced spreadsheet users depend on this technique. Try this.
   Position cursor at A1.
   Enter 5
   ↓
   +
   ↑
   +7
   RETURN
   You will see a 12 in cell A2. If you look at the cell indicator line it displays:
   A2: (VALUE) +A1+7
   This means that cell A2 is pointing to cell A1 and it will automatically add 7 to any value that is put in A1. Since there is a 5 in A1 the value in A2 is 12. If you change the value in A1 the value in A2 will change as well. Change the number in A1 and watch the number in A2 change accordingly.

- Pointers can also be used to specify the endpoints of a range of data. Let's find the sum of the grades in row 7. Position the cursor at H7, where you would like the SUM to appear. Type "@SUM(", move the cursor with the left arrow until it is positioned over B7. Next type a period ".", you will see " SUM(B7..." displayed on the EDIT/ENTRY line. Move the cursor with the right arrow and see Appleworks highlight each entry in the seventh row. Stop at G7 and press RETURN. Your cursor has returned to H7. Close parentheses and press RETURN. Your sum should now appear in H7. This technique is very useful when your data has scrolled out of view and you cannot remember the coordinates of the endpoints.

9. Sometimes an entry such as 11B is required. Product numbers very often contain both letters and numbers. We cannot call this a value because of the letter. Combinations of letters and numbers are usually referred to as alphanumeric displays. These entries are really labels and we do not want them thought of as values. To indicate to Appleworks that we are entering a label when

the entry begins with a digit (0...9), a parenthesis, a "+", "-" or ".", we begin our entry with the " key. This key is not recorded as part of our entry. It is simply a signal to Appleworks that the entry that follows is a label and not a value.

10. Another very powerful feature of Appleworks is its ability to sort both numerically and alphabetically. Load the MYGRADES file and position the cursor over the first entry in the Test 1 column. Access the arrange command with "Open Apple-A". You are asked to highlight the range you want sorted. When a column is sorted the entire row is kept intact. For example since 65 is the lowest number, the entire Math row will be moved to the bottom. Move the cursor so that the complete sheet is highlighted and then press return. You are now asked how you want the data sorted. Since this data is numbers we can use ascending (0 to 9) or descending (9 to 0). Let's place the highest grade first and choose option 4.

11. After pressing return we see that Typing has moved to the top and Math occupies the bottom line. Now the subjects are no longer in alphabetical order. To correct that place the cursor over Typing and press "OPEN APPLE-A". Move the down arrow until all the subjects are highlighted and then press return. This time choose option 1 and our subjects will be arranged in alphabetical order, from A to Z.

APPLICATIONS:

1. Create a worksheet listing at least ten student names:
   a) Save it to the disk.
   b) Clear the screen.
   c) Load it back again.

2. Jump cursor to several locations across the worksheet. Blank out these entries.

3. Enter 5 sets of grades and perform calculations using the built in functions.

4. Reload the MYGRADES file and:
   a) Delete a given test column.
   b) Replace with the insert command and enter new data.
   c) Delete a given subject row.
   d) Replace with the insert a row command, a new subject and grades.

5. Use pointers with simple operations such as (+D3*7).

6. Find the average grade for each subject in the MYGRADES file. Sort the averages numerically to determine the subject with the highest average.

SUGGESTIONS FOR LAB SESSIONS:

- Load any of the work sheets created in previous sessions:
  1) Jump the cursor to various positions.
  2) Use the BLANK command to erase the data.
  3) Use the DELETE and INSERT command.
  4) Discuss how rows and columns can be deleted or inserted with the cursor in any position within the column or row.
  5) Calculate sums, averages, find minimum and maximum numbers, on both rows and columns.

SUMMARY:

1. Describe how you would load the file named MILEAGE.

2. What command advances the cursor from A10 to AA10?

3. When the cursor is over cell D15 containing the entry 67, what is displayed on the spreadsheet's cell indicator line? ... X1 containing the entry CHICAGO?

4. When do we use the @ key?

5. Consider the sets of data: 80,80,90,(blank),83,85 in six columns, and the same set in five columns (with no blank). Compare the result of using the average function on both sets (the same). Compare the result of using the minimum function on both sets (first set 0, second set 80).

6. What is the fastest way to erase all data from the spreadsheet?

7. If you are finding the average of a very long column of numbers and the end of your data has scrolled out of view should you:
   - a) Press ESCAPE and begin again.
   - b) Use the arrow keys to position the cursor at the endpoint and then press RETURN.
8. Mary Kim is in official class 5C. How should this official class designation be entered on the spreadsheet?
9. What do I mean when I say that Appleworks sorts?
10. In what ways does Appleworks sort?

HOMEWORK:

1. How can I load a file that I saved last week if I forgot the name of the file?
2. List 2 ways of advancing the cursor from A1 to BK254.
3. What does Appleworks mean when it refers to its desktop? Can more than one file be located on this desktop?
4. What will Appleworks answer to:
   DATA 73,68,(blank),79,82,90.
   - a) @ MIN
   - b) @ MAX
   - c) @ SUM
   - d) @ AVG
   - e) @ COUNT
5. What is the fastest way to erase the following:
   - a) The data in C20.
   - b) The data in row 5.
   - c) The data in column A.
   - d) The entire worksheet.

HOMEWORK SOLUTIONS:

1. Appleworks saves filenames along with the date saved. If the filename was chosen poorly and you cannot remember by just looking at the names in the catalog then check the dates. A combination of the two is generally all you need to remember.

2. The long way is to advance pages using the OPEN APPLE in conjunction with the arrow keys. The short way is to use OPEN APPLE-F, the FIND command. Choose the coordinates option and enter BK254.

3. The desktop is the part of the computers memory that is used to save files. You can save up to 12 files on the desktop.

4. a) 68
   b) 90
   c) 392
   d) 78.4
   e) 5

5. a) BLANK an entry.
   b) DELETE a row or BLANK a row.
   c) DELETE a column or BLANK a column.
   d) Use the MAIN MENU and the "Remove Files from the Desktop" option.

CONSUMER MATHEMATICS

Introduction to the electronic spreadsheet (Appleworks)

LESSON: 3L

AIM: What are the ways that Appleworks formats data?
What techniques are used to change these formats?

PERFORMANCE OBJECTIVES: The student will be able to...

1. Define terms:
   - a) Default
   - b) Format
   - c) Global
   - d) Justify
   - e) Truncate
2. Recognize and change Appleworks' default formatting for:
   - a) Values
   - b) Labels
3. Choose other formats for values, such as:
   - a) Appropriate
   - b) Dollar-and-cents.
   - c) Fixed decimal.
   - d) Comma
4. Change the formatting of:
   - a) Single entries.
   - b) Columns
   - c) Rows
   - d) Blocks of data.
   - e) The entire worksheet.
5. Change the column width of:
   - a) All columns.
   - b) Select columns.
6. Understand the way that Appleworks recalculates during:
   - a) Automatic recalculation.
   - b) Manual recalculation.
7. Appreciate protection schemes that are built into the spreadsheet to preserve a user's data, and the commands that will eliminate this protection.

VOCABULARY: default, justify, global, truncate, automatic recalculation, manual recalculation

MOTIVATION:

What is the meaning of the word "default"? (According to Websters' New World Computer Dictionary: A value, parameter, attribute, or option that is assigned by the program or system when another has not been specified by the user.)

- What are some of these options that Appleworks assigns to the data and how can they be changed?
- When changes are made, will it effect all data or can we limit these changes to specific sections of the worksheet?
- Does Appleworks protect data from being changed by the user?
- What do we mean when we use the words justification and formatting?
- Once a formula has been calculated what happens if we change a number?

DEVELOPMENT:

1. Have students enter the following data into Row 1: 9,3,453,apple,test.
   The spreadsheet should look like this.

```
 ===A======B======C======D======E===
1      9      3    453APPLE   TEST
```

Elicit that when entering values the numbers are placed to the right side but the labels are placed to the left side. Enter the following display on the chalkboard.

```
Test 1     Test 2
90            100
100            99
87             75
etc..
```

Elicit that it is confusing to left align values. Have students enter the word computers and the value 123456789 next. Ask them how these entries are aligned. Lead students to understand that the alignment of an entry only has meaning when the position it is being placed in is bigger than the entry. (When the data is shorter in length than the available field.) Teach them the word "justify". Lead them to verbalize the following. The default justification for labels is left. The default justification for values is right.

2. Have students enter the following display:

Test 1	Test 2	Test 3	Test 4
88	87	79	92
100	98	85	92
81	89	100	78

Elicit that the labels are left justified and the numbers are right justified. Discuss the appearance of this sheet and conclude that this would be less confusing if the test numbers were aligned with the test grades. Explain to students that although Appleworks default justification for labels is left, this can be changed by the LAYOUT COMMAND.

a) To right justify the test numbers we must first position our cursor in Row 1 (since that is the row that contains the test numbers).
The LAYOUT COMMAND is accessed by pressing "Open Apple-L". The following display appears on the bottom line:
(Layout? Entry Rows Columns Block)
We wish to change the format of the labels which are in the top row. Make sure the cursor is positioned in that row and then move the cursor to select the row option. You are now prompted to move the arrows to highlight all the rows that you wish to change. We will press Return because we only wish to change the first row. The following display appears on the bottom line:
(Layout? Value format Label format Protection)
We wish to change the Label format. Choose that option. The display then reads:
(Label format? Left justify Right justify Center Standard)

Have students select the right justify option. After they press return they should see the following display:

Test 1	Test 2	Test 3	Test 4
88	87	79	92
100	98	85	92
81	89	100	78

b) The "Center" option centers the labels in the field. If a 4 character label is placed in a 9 character field and then centered the 5 blanks would be arranged, 2 first, 3 last. Students can be directed to load the MYGRADES file and center the subject names that are located in the first column.

c) The standard option returns the label format to the default justification (left).

3. Have students begin a new worksheet. Pose the following problem. The student organization is planning to record Ticket Sales for their next Theater Presentation, on Appleworks. The cost of tickets are $3.50 for members, $4.00 for students who are not members and $4.75 for friends and relatives of students. Advanced sales have begun and records indicate the following sales:
   Monday - $3.50, $3.50 and $4.00.
   Tuesday - $3.50, $4.00, $4.00 and $4.75.
   Have students enter this data on the spreadsheet. The first problem will be the "$". As soon as they try to enter this character they will hear the "honk". The only way this can be entered is with the ". Remind students that this is not acceptable as we will surely want to do arithmetic operations with these values and entering them as labels would defeat our purpose. Have them conclude to eliminate the dollar sign. Another problem will be 3.50 will appear as 3.5, 4.00 will appear as 4, and 4.75 will be the only number to contain the two decimal places required to represent dollars and cents. Tell students that Appleworks always eliminates trailing zeros to the right of the decimal point. To eliminate these problems Appleworks contains several value formats that help in

clarifying the types of values that we are planning to use. The student worksheet should look like this:

Monday	Tuesday
3.5	3.5
3.5	4
4	4
	4.75

The Value format we are looking for is dollar-and-cents mode. This can be accessed by using the LAYOUT COMMAND. Remember how this command works. First we position our cursor and then we indicate the specific area of the sheet that we wish to reformat. When we are reformatting the entire sheet and not just a row or entry we use a different command. The command that we use changes the standard default values. The name is STANDARD COMMAND.

4. The STANDARD COMMAND is accessed by typing "Open Apple-V". The display on the bottom line is:
   (Standards? Value format Label format Column width Protection Recalculation)
   Choose Value format. The options become:
   (Value Format? Fixed Dollars Commas Percent Appropriate)
   a) Choose the Dollars option. Appleworks then prompts you for the number of decimal places you wish (0-9). This question seems a bit unnecessary since dollar-and-cents format requires two decimal places. Appleworks will permit entries like $4.5678. If time permits these entries might amuse students. Answer the decimal place question with the number 2. As soon as the student presses return the display should change to:

Monday	Tuesday
$3.50	$3.50
$3.50	$4.00
$4.00	$4.00
	$4.75

b) Choosing the Appropriate option will return the display to the way it was originally. We say that the default format for values is Appropriate. In general this means that values are displayed as they were entered. There are exceptions. Trailing zeros to the right of the decimal point are not displayed. Commas cannot be entered in large numbers. An attempt to enter 345,566 would result in a "honk" as soon as the comma is typed. Tell students that when we change Appleworks standard values so that every value on the sheet changes, we call this a GLOBAL change. When we reformat specific entries or blocks of data we call this a LOCAL change.

c) The Fixed option specifies the number of decimal places to be represented. Have students choose this option with two decimal places and conclude that it could be used to represent dollar-and-cents format. The only difference is that the dollar sign is missing. Have students select other amounts and see the display change. By selecting zero decimal places they will see the numbers rounded off.

d) Have students choose the percent option. This option also requires a specified number of decimal places. Choose zero. Now each cell has been multiplied by 100 and a percent sign has been affixed to each entry. The display looks like this:

```
Monday   Tuesday
     350%     350%
     350%     400%
     400%     400%
              475%
```

e) The commas format is used when numbers are large and the addition of commas would help clarify data. Enter 123456 in an empty cell. With the cursor still over that cell enter the LAYOUT COMMAND with Open Apple-L. Choose the entry option and then the value format option. Finally choose the commas option and see the display change to 123,456. Notice that no other data on the sheet changed. This is because we are not using the STANDARD COMMAND to change the values globally. You have to be careful with the comma option. Enter 123456789 in a blank cell and then repeat the above process to change the layout of only this entry to comma format. If you did it correctly you will see ######### on the spreadsheet. This is caused by the column width being too small to hold the number 123,456,789. We will learn how to correct this shortly.

f) The standard option restores the cells to the spreadsheet's default formats.

5. Have students create a worksheet that will display the following data:

3 tickets were sold at $3.50 yielding $10.50
3 tickets were sold at $4.00 yielding $12.00
1 ticket was sold at $4.75

Elicit column heading. TICKETS COST TOTAL students should begin a new worksheet and the result of entering the above data should look like this:

```
TICKETS  COST      TOTAL
        3       3.5     10.5
        3         4       12
        1      4.75     4.75
```

Have students conclude that the labels should be right justified. Do this with the STANDARD COMMAND. Next have them suggest dollar-and-cents format. Make sure they understand that if this is done with the STANDARD COMMAND that the data in the tickets column will be changed as well. Lead them to see that they must use the LAYOUT COMMAND on the block of data which includes the ticket cost and total sales for each ticket.

6. Ask students how many characters are in the width of each column. Lead them to say "the default column width is 9". Tell them that this can be changed. If they wish to make a global change they would use the STANDARD COMMAND.

a) Have students start a new worksheet. Name it Thin. Begin with 10 and enter all the multiples of 10 through 90. Tell students that Appleworks can contain column widths of 1 to 75 characters. These limits are rather extreme. Choose to make the current column width 4. Select the STANDARD COMMAND with Open Apple-V. Choose the column width option. Read the display on the bottom line. You are told to move the arrows in conjunction with the Open Apple key to change the column width. If you move the left arrow, the column gets smaller. If you move the right arrow the columns gets wider. To change from 9 to 4 we must press "Open Apple—←" five times. When the desired column width is attained, press the Escape key. All columns have been changed to be 4 characters wide.

b) A very special feature of Appleworks is that the column widths of any given spreadsheet need not all be the same. Let us add two columns to our Thin worksheet that will contain first and last names. It will be neccesary to insert two columns for this purpose, do so with the cursor in column A. We have two blank 4 character columns that we would like to change to 15 characters each. Elicit that this cannot be a global change. Since this is a local change we will use the LAYOUT COMMAND. Have students type the following sequence. Make sure the cursor is in the "A" column.
Type "Open Apple-L".
Choose the "column" option/press "Return".
Press the "right arrow" to highlight the "B" column/press "return".
Choose the "column width" option/press "Return".
Press "Open Apple—→" eleven times.
Press "Escape". This should result in expanding the first two column widths to 15 characters, while the others remain at the 4 character width.

7. Have students reiterate what they learned about Appleworks default values.
   Labels are left justified.
   Values are Appropriate mode and right justified.
   Column width is 9 characters.
   Tell students that Appleworks default recalculation is automatic. To understand what this means have them create a new worksheet called SUM.

```
 ====A========B========C====
1        2        3        5
2        1        1        2
3        4        7       11
```

   Have students realize that the values in the "C" column are the sum of the values in the "A" and "B" column. It is important that the C column be created using the SUM FUNCTION. This is a good time to review "@SUM(A1.B1)" with the cursor positioned over C1. When all three sums are calculated move the cursor to A1 and change the entry to 6 by typing "6/return". Direct student attention to the "C" column. Notice that the entry in C1 is now "9". Have students explain that Appleworks changed the answer when we changed the example. Next, jump the cursor with the FIND COMMAND to B3. Change the value to an "8". Watch the entry in C3 change to "12". Tell students that this is an example of another standard value that the result displayed in a given cell must be the result of performing some operation on other cells. This operation will be carried out again and again. If you keep changing the data, Appleworks will keep changing the answer. Ask students if they think this default option can be changed. If their answer is yes, they will also be able to tell you that it can be changed globally with the STANDARD COMMAND.

   a) If recalculation is not carried out automatically it will have to be done manually. Access the STANDARD COMMAND with "Open Apple-V", choose the Recalculate option. You are prompted to select Order or Frequency. Select Frequency and press return. Now you may choose automatic or manual. Since default is automatic and we wish to change the standard value, we will select manual. Return to the SUM worksheet and change data. The "C" column remains unchanged. Move the cursor to the "C" column and check the cell indicator to make sure that the SUM is still there.

b) The order option refers to the way Appleworks calculates. We suggest the presentation of this topic be left to the discretion of the teacher. The default calculation is down columns first and then across rows. It is sometimes necessary to change this to across rows first and then down columns. This is accomplished by choosing the Recalculate option of the STANDARD COMMAND and then choosing Order. If you specify rows the default calculation is changed to rows first.

8. The last default value is the built in PROTECTION scheme that Appleworks uses. The default global protection is "ON". This means that you have the option of protecting your data from accidentally being erased or written over, by you or anyone else that uses your sheet. If you change this protection to "OFF", you no longer have that option. To eliminate all possible protection:
Type Open Apple-V.
Choose Protection/Return.
Choose No/Return.
If the default protection is left unchanged, that is "ON", using the LAYOUT COMMAND permits us to access various types of protections. After selecting the LAYOUT COMMAND we are prompted to choose entries, rows or columns in the usual manner. Now we are highlighting the regions we wish to protect.

a) The "Labels only" option insures that we cannot insert a value in the specified region. If we choose to change the label however, we can change it to another label.

b) The "Value only" option works in a similar fashion. Now we cannot enter labels in the specified "value only" region.

   c) "Nothing", is complete protection. Any character typed over an entry protected in this manner will cause Appleworks to "honk".
   d) "Anything", gives no protection at all.

9. Other protection schemes employed by Appleworks could be pointed out at this time.
   a) When an entry is being typed over previously entered data the message in the upper right hand corner changes to read, "Escape: Restore former entry". By pressing Escape the new data, that you were about to enter, is erased and the former entry appears, unchanged.
   b) When trying to INSERT, DELETE, or BLANK out regions that contain data, Appleworks asks you to think over that you are about to do.
   c) If an attempt is made to load a file that has been previously loaded to the desktop, you are given an opportunity to think over your rash actions.

10. Sometimes we try to do something that is mathematically impossible. Other times we may accidentally hit the wrong key. In instances such as these we may see the word ERROR appear in a nearby cell. This is Appleworks way of telling us that we are asking for something unreasonable. One such unreasonable request is to ask Appleworks to divide by Zero. Have students explain why this is not allowed. Try the following:
    Position the cursor at B50.
    5
    ↓
    +
    ↑
    /0 Return
    The word ERROR will appear in B51.

APPLICATIONS:

1. Experiment to see how the spreadsheet accepts different data when various formats are in effect.

2. Change column widths until:
   a) Only ### appears notifying user that more space is needed to display an answer.
   b) Numbers are truncated by shortening column widths. Prepare a column with nine entries, beginning with 1, then 12, then 123, and ending with 123456789. Examine what happens as columns are shortened. Define truncating for students as the act of loosing digits from the right of the number.
   c) Type a label larger than the existing column size. Notice that only a portion of the label appears. Expand the column width until the complete label appears on the body of the spreadsheet.
3. Protect a section of the worksheet with the "Nothing" option of the LAYOUT COMMAND. Make sure that the Standard protection is "ON". Pass the cursor over the protected region and read the Cell indicator line. Have students explain the meaning of "(Protect-N)", that appears only in the protected region.
4. Try and correct data that has been previously entered with the default protection turned on. Repeat this process after you have changed to NO PROTECTION. Discuss the use of the LAYOUT COMMAND in conjunction with the STANDARDS COMMAND for accessing protection.
5. Enter a list of names, first and last in two columns. Change the justification. Explain why values and labels have different default justifications. Explain why labels can be changed from default left to right, but values cannot be left justified.

SUGGESTIONS FOR LAB SESSIONS:

- Load previously prepared worksheets:
  a) Change justifications.
  b) Change column widths.
  c) Change to dollar-and-cents format:
     1) By entry.
     2) By column, row, or block.
     3) Entire sheet.

d) Change to comma format.

e) Format one column of numbers in percent format, another column in dollar format.

f) Round decimals to different precision in different columns using the fixed decimal format. Set up column A for a one place fixed decimal, column B for two places, etc. Experiment entering the same number, such as 4.51627489, into the differently formatted columns.

g) Change protection schemes.

SUMMARY:

1. What is the default justification for entering numbers? Labels?
2. What is the disadvantage of entering a value, such as $8.00, as a label using the " key? (Appleworks would treat it as label and no operations could be performed on it.)
3. Is it necessary to choose the number of decimal places when specifying "dollar" format?
4. What is the default column width?
5. What would happen if we tried to divide the contents of cell B5 by Zero and put the answer in B6?
6. Can we recover from typing over previously entered data, that is not protected, before it is entered?
7. Can we protect an entry with our LAYOUT COMMAND if the STANDARD value is "OFF"?
8. Can values be left justified?
9. What does the word truncate mean?
10. What format represents all values with 3 decimal places?

HOMEWORK:

1. Cell R47 contains the entry .789 and the cursor is positioned over the entry. What will appear in both Cell R47 and on Appleworks cell indicator line as a result of

choosing the following options.
"Open Apple-L"
"Entry"
"Value format"

	OPTION	R47	Cell indicator
a)	Fixed-2		
b)	Fixed-0		
c)	Fixed-1		
d)	Percent-1		
e)	Percent-0		
f)	Dollar-2		

2. Return to questions one. Answer a-f if cell R47 contained the entry 7.291.

3. Explain how the dollar option with two decimal places of the "Open Apple-V" Command will effect each of the following.
   a) 1.053
   b) 3.89
   c) 7
   d) MONEY
   e) ****

4. Explain how you would change the "B" column width to 10 characters wide.

5. Collect 3 formulas that you remember from previous Mathematics courses. Use these formulas on numbers of your choice and save them in your notebook. We will need these formulas the next time we use the electronic spreadsheet. At that time you will have an opportunity to check your work.

HOMEWORK SOLUTIONS:

1.	OPTION	R47	Cell indicator
a)	Fixed-2	.79	Value (Layout-F2).789
b)	Fixed-0	1	Value (Layout-F0).789
c)	Fixed-1	.8	Value (Layout-F1).789
d)	Percent-1	78.9%	Value (Layout-P1).789
e)	Percent-0	79%	Value (Layout-P0).789
f)	Dollar-2	$.80	Value (Layout-D2).789

2.	OPTION	R47	Cell indicator
a)	Fixed-2	7.29	Value (Layout-F2) 7.291
b)	Fixed-0	7	Value (Layout-F0) 7.291
c)	Fixed-1	7.3	Value (Layout-F1) 7.291
d)	Percent-1	729.1%	Value (Layout-P1) 7.291
e)	Percent-0	729%	Value (Layout-P0) 7.291
f)	Dollar-2	$7.29	Value (Layout-D2) 7.291

3. a) $1.05
   b) $3.89
   c) $7.00
   d) no change
   e) no change

4. Choose the column option of the layout command. Highlight column B only and then Return. Choose the column width option, press return, press the right arrow in conjuction with the Open Apple key and press Escape

5. We hope that students will remember some formulas from geometry such as perimeter, area or volume.

CONSUMER MATHEMATICS

Introduction to the electronic spreadsheet (Appleworks)

LESSON: 4L

AIM: How do we use the COPY COMMAND to replicate large lists of data?
Why is it no longer necessary to rewrite a formula each time we use it?

PERFORMANCE OBJECTIVES: The student will be able to...

1. Use the COPY COMMAND and copy to a specified area of the spreadsheet:
   a) A single entry.
   b) A row or column.
   c) A block of data.
2. Review previously learned Appleworks functions.
3. Replicate these functions by:
   a) Entering coordinates.
   b) Using the cursor as a pointer.
4. Differentiate between Source range and Target range.
5. Write a simple formula and replicate it using:
   a) Columns
   b) Rows
6. Reference other locations with:
   a) No change.
   b) Changes Relative to the locations.
7. Use the ZOOM COMMAND to toggle between displaying the formulas in every cell or the normally displayed numbers.

VOCABULARY: replicate, source, target, range, variable, constant

MOTIVATION:

In the past, when it was necessary to calculate our subject average, we calculated each average separately. Either we used our calculators or the spreadsheet. Some of you may remember my saying that the spreadsheet can find everybody's math average in seconds. Even if everyone has taken 10 math tests.

- Teacher will demonstrate finding averages on a previously prepared data disk. Student will have the opportunity to review the method of loading a previously prepared file, jumping the cursor, and using a built in function.
- Tell students that today we will learn how Appleworks' most spectacular command permits us to copy data and replicate a formula.

DEVELOPMENT:

1. The copy command and the process of replicating data and formulas is the most powerful command that Appleworks offers. Once students have mastered this command they are ready to fully enjoy the "speed of computing" that the spreadsheet offers. Begin with the technique of copying one entry to a different location. Have students create an addition table. Enter the word plus in A1 and the digits 1,2, and 3, in B1, C1, and D1, respectively. We wish to replicate the "1" in B1, and place it in A2. Position the cursor over B1 and press Open Apple-C. The display that appears on Appleworks bottom line is.
   (Copy? Within worksheet To clipboard From clipboard)
   Choose "within worksheet". The other two options will not pertain to anything in this course. We will work exclusively with the spreadsheet. The cursor is positioned over "within worksheet", thus we need only press return. The technique of pressing Open Apple-C and then Return permits us to copy within the worksheet. Our instructions are now to use cursor moves to highlight source. The word source, in this context, refers to the region we wish to copy. Draw a parallel between the word "source" and the word "beginning". Develop the following vocabulary.
   - The process of replicating data is the process of copying that data, one or more times, to a new location.
   - The source is the region that answers the question: What will be copied?

- The target is the answer to the question: Where do you want it copied to?
- The range refers to the starting and the ending coordinate of the region in question. The source range may be only one location. In that case Appleworks displays B1...B1. On the other hand if we copy to a segment of a column the target range might be B1...B10, where B1 is the beginning of the replicated data and B10 is the ending coordinate.

  To continue with the COPY COMMAND. The arrow keys will move the cursor to highlight the row or column that we want to copy. Our aim is to copy only one entry, one time. We therefore press Return. The bottom line displays:

  (Move to a new location, then press "." or return.)

  The new location that Appleworks is referring to is the target. The region that we wish to copy our data to, in this case, is A2. Use the arrow keys to move cursor to A2 and then press Return. You will see the "1" appear in A2.
- Have students copy "2", into location A3:

  Position cursor over C1.

  Press Open Apple-C, Return, Return, ↓, ↓, ←, ←, Return.
- Continue in this manner until the following Addition Table has been completed.

	A	B	C	D
1	Plus	1	2	3
2	1	2	3	4
3	2	3	4	5
4	3	4	5	6

2. Tell students that you gave a test to a class of 34 students. Every student in that class received the same grade on this current test as they had received on the previous test. Ask students how they think the spreadsheet should be used to enter this data. We hope they will tell you to replicate the previous grades. Create a new spreadsheet, name it OURMARKS. Enter 34

grades in column C and label it TEST 1. If time permits enter first and last names in columns A and B. Label D1, TEST 2 and prepare to copy C2 through C35 into D2 through D35.

1. Position cursor over C2.
2. Press Open Apple-C, Return.
3. Hold the down arrow depressed until C35 is reached.
4. Press Return (cursor returns to C2 automatically).
5. Move cursor to D2, press Return.

Watch the entire column of grades being copied into column D.

- Tell students to make believe that this phenomenon happened three more times. What we plan to do is to copy the grades into three columns at once.

1. Follow steps 1-4 above.
2. Move cursor to E2.
3. Press "." (indicating a Target Range is coming).
4. Highlight columns E,F, and G with appropriate cursor moves.
5. Press Return.

The spreadsheet enters three sets of grades for us. When we pressed the "." the display on the bottom line showed "...". Appleworks uses the three period display to indicate a range.

3. Continue with the Ourgrades file. On the next test everyone received a grade of 100. Elicit that you enter 100 once and then replicate it thirty-three times. This is TEST 6 and is located in column H.

1. Enter 100 in H2, press Return.
2. Open Apple-C, Return, Return.
3. Highlight target range, H3...H35, Return.
4. Watch 34 one hundreds appear in row H.

Have students enter all 90's for TEST 7 in row I.

1. Enter 90 in I2, Return.
2. Open Apple-C, Return, Return.
3. Move cursor from I3 through I35, Return.

Save the file and clear the worksheet with the BLANK COMMAND.

4. Up to this point we have been replicating columns. Rows can be copied too. Create the following row.

	A	B	C	D	E
1	3	9	27	81	243

We wish to copy row 1 to row 10.

1. Position cursor over A1.
2. Press Open Apple-C, Return.
3. Highlight columns A through E, press Return.
4. Move cursor to A10, press Return.
5. Appleworks copied the five numbers.

It is important that students understand how Appleworks remembers that five numbers must be copied. Lead students to verbalize the following rule.

- When the target range and the source range are the same size, pressing return is all we need to complete our copy. When the target range is larger than the source range we must specify the beginning coordinates of the target range, press the period and position the cursor with the arrow keys to the ending coordinates. Have students copy row 1, five times, into rows sixteen through nineteen.

1. Position cursor in A1.
2. Open Apple-C, Return.
3. Arrow cursor over all five entries, press Return.
4. Position cursor over A16 and press "."
5. Highlight rows sixteen through nineteen, press Return.
6. Watch all five rows appear on the screen.

5. The process of learning how to write, and replicate a formula is the first step some students will take toward programming a computer. Tell students they are about to teach the spreadsheet to perform a task. Before we can teach Appleworks anything it is wise to have some available data so that we can see the results of our instruction. Clear the worksheet with the Blank command and enter 3,7,12,25,48,96 in column A. Let students decide what they want to teach the spreadsheet. Keep it very simple. Something like "add 3", "divide by 2", etc.

After the class has made its decision everyone should work together. Let us assume the class agreed to teach the spreadsheet to add 5. When writing formulas the rule is to position the cursor where you want your answer to appear. Agree to place the results (of adding 5 to the A column) in the B column. Place the cursor in B1.

- Enter + A1 + 5, Return.
- Eight will appear in B1.

This can also be accomplished by using the cursor as a pointer.

- Position cursor in B1.
- Type +, ◂, +5, Return.
- Eight will appear in B1.

In both cases read the formula on the cell indicator line, + A1 + 5. Tell students that the A1 in the formula is called a variable. It is used to represent the number that is in cell A1. Right now there is a "3" in cell A1, but if we decided to change it, then A1 will represent whatever number we change it to. Direct students to write a formula fo the next example, using a variable. "A2 + 5", and A2 represents the number "7". The next formula is "A3 +5", etc. Tell students that the variable changes relative to the cell location. Explain that we are going to replicate this formula relative to each of the remaining cells.

1. Position the cursor over the cell that contains the formula you wish to replicate. (B1)
2. Press the following sequence of keys: Open Apple-C, Return, Return, ".", ↓ , ↓, ↓ ,↓ ,↓ , Return. R, Return (to select the relative option).
3. Appleworks fills B2 to B6 with values 5 more than the corresponding A values. Return the cursor to B1. Depress the down arrow and read the display on the Edit/Entry line for each occupied cell in the B column. Students will see how the variable changes relative to the given location. Practice this technique by selecting two more very simple formulas.

- During the lesson I suggest clearing the worksheet with the Blank command. Review sending the cursor to A1 with

Open Apple-F, choosing the coordinates option, entering A1, and blanking out all columns or all rows. In the previous lesson we cleared most sheets by clearing the desktop. We aim to make students familiar with all commands. Later on we can just tell them to clear their worksheets and let them make their own choices.

6. Tell students we are now going to create a multiplication table. We will save the worksheet and print it at a later data (as soon as we learn how to use the printer). This table will be created from a single "1" that we will enter into cell A1, the replicate command and a few simple formulas that we are goint to write. Name the worksheet XTABLE and enter the "1" into coordinate A1. Write a formula that will successively add 1 to each number. This table can be made any size at a latter date. For this lesson I suggest we limit it to ten. The formula will be A1 + 1.
    1. Position the cursor over B1.
    2. Press +, ←, +1, Return.
    3. Press Open Apple-C, Return, Return.
    4. Press the Period and move the right arrow 8 times to the J column.
    5. Press Return.
    6. Press →, Return (to choose relative).

    Call these the multiples of ONE and direct students to create the multiples of TWO.

    1. Position cursor over A2, +, ↑ , *2, Return.
    2. Copy step 3 above.
    3. Same as step 4 with nine arrows, copy steps 5 and 6.
    4. The multiples of two should now be displayed on the worksheet.

    Have students understand that the formula they created was A1*2 and that this formula is set up to change relative to each location. Point to the "2" in the formula. Ask students if this "2" is a variable. Lead them to see that it is a constant. Discuss the formulas that will be needed to complete this table. A1*3, A1*4, A1*5, ...A1*10. We are going to copy the formula A1*2 into all the cells in column A ending with A10. Clearly we do not want all rows to be multiples of 2. Remind students of the Edit Command. Lead them to understand that we can edit the formula A1*2, by changing the 2 into a 3, and then a 4, and then a 5, etc. Our plan is to copy this formula and then to edit the constant.

1. Position the cursor over A2.
2. Press Open Apple-C, Return, Return.
3. Press the period.
4. Press ↓ eight times, Return, Return.
5. Stress the selection of NO CHANGE. We want our variable A1 to remain the same. Remember it is the constant that we wish to change.

7. Review the EDIT COMMAND. Elicit that the current cursor, "the dash" is a reminder that we are in insert mode. Editing formulas is the same as editing labels and values. Access the EDIT COMMAND with Open Apple-U. The formula can be seen on the Edit/Entry line, the middle line of the three bottom lines. When a label or formula is being edited on the Edit/Entry line pressing Open Apple-Y will erase all characters to the right and including the current cursor position. For the label America, if the cursor is over the M, and Open Apple-Y, Return is pressed, only the A will remain. To enter "change mode" use Open Apple-E and see the flashing square cursor. This is generally the best mode for editing. After this every time we press Open Apple-E we toggle between change and insert mode. To begin editing our formula we must position the cursor over A3. Press Open Apple-U and enter the EDIT COMMAND. Access the change mode with Open Apple-E and focus your attention to the formula that appears on the EDIT/ENTRY line. Move the right arrow 4 times until the cursor is over the "2". Type the "3" key and then press Return. Change the next formula: , Open Apple-U, → four times until the cursor is over the "2", type a "4", Return. Continue the above routine until all ten formulas are corrected. You will see the numbers 1 through 10 in the A column.

8. The body of the table is completed by replicating these formulas across the rows.
    1. Position the cursor over A3 (correct formula is on cell indicator line).
    2. Press Open Apple-C, Return, Return.
    3. Press the period.
    4. Press →, nine times, Return.
    5. Press →, Return (to choose relative).

    Repeat the above routine. Position the cursor over A4, A5, A6...A10, until the table is complete. Students will benefit form the repetitious nature of this exercise if they are questioned as to the difference between NO CHANGE and RELATIVE CHANGE. Stress that the formulas in column A all depend on A1, but the formulas used to create the rows, depend on cells that change, relative to each column. We make our final point, in the next section, by seeing all the formulas that the spreadsheet has to learn to that this multiplication table could be created from a single "1".

9. The Zoom command is designed to change all values into the formulas that were used to create them. It is accessed with Open Apple-Z. We call this Zooming in to see the formula. You will be able to see only the part of the formula that fits within the cell. The formulas that we used to create our worksheet were only five characters. Since the default column width is nine we will have no difficulty seeing all our formulas. Have students Zoom in on their formulas, except for the lonely "1" in cell A1. You can take this opportunity again to stress the difference between "No change" (column A) and "Relative Change" (everywhere else). To return to our normal display, our multiplication table, press Open Apple-Z again. Students should be permitted to toggle back and forth with the ZOOM COMMAND.

10. Have students save this worksheet with the SAVE COMMAND. If possible students should be encouraged to have their own data disk. This disk can be used in the daily lessons as well as during lab sessions. Personal student

files can be created and saved on this disk. Each disk could belong to one student or a group of students and be collected at the end of the session, by the teacher, for safe keeping.

APPLICATIONS:

1. Load the MYGRADES file and replicate TEST 2 in column headed TEST 7.
2. Find the average of the English grades and then replicate the average for each subject, down the column.
3. Find the average of the grades in TEST 1. Replicate this built in function for each test, across the row.
4. Find the minimum grade for each subject by finding the TYPING MINUMUM and then replicating up the column, using pointers.
5. Enter a new subject, LATIN, in the following manner. Insert a row between Hygiene and Math. Enter the label LATIN in the subject column. Replicate the row of Math grades by copying that row of grades into the one we just created for the LATIN grades.

SUGGESTIONS FOR LAB SESSIONS:

- Students should be encouraged to keep their own personal grade statistics on the worksheet. The files could be named by using their names or a combination of their initials and the word "grade", "marks" or "scores".
- The multiplication table could be extended to "12 x 12" or "25 x 25".
- Have students offer formulas that they collected in a previous homework assignment. These formulas should be entered and replicated for groups of data.
- Calendars can be created with the replicate command by adding one and properly formatting.
- The bisection algorithm always fascinates students. Begin with any number and successively divide by 2.

SUMMARY:

1. What is so special about Appleworks ability to copy?
2. What is a source range? A target range?
3. Where must the cursor be when we type Open Apple-C?
4. Can rows be replicated directly into columns? (no)
5. Can we make five copies of one row? (yes)
6. What is the difference between "No change" and "Relative change"?
7. What does the period indicate when using the copy command?
8. What is a variable?
9. What is a constant?
10. Can formulas be edited? Explain?
11. What is the result of pressing Open Apple-Z?

HOMEWORK:

1. Write a formula that will:
   a) Multiply the contents of B5 by 12.
   b) Add 6 to the contents of C1.
   c) Divide X3 by 15.
   d) Subtract 32 from D41.
   e) Double J12 and then add 7 to the result.
2. Name the variable(s) in each formula:
   a) @AVERAGE(T14...AA14)
   b) @SUM(H5...L5)/M5
   c) +B2*17
3. a) Which, if any of the formulas in ex. 2 contains a constant?
   b) Which, if any, of the formulas in ex. 2 contains a built in function.
   c) Where should the cursor be positioned if we want our answer to appear in cell A50.
   d) What is the result of executing ex. 2c, if cell B2 contains the number 17.

e) What is the result of executing ex. 2b using the following data. The cursor is positioned on cell N5.

	H	I	J	K	L	M	N
5	70	75	80	85	85	5	

4. I wish to replicate the formula C1*15 that yielded the 30 in D1, so that the remaining numbers in column C will be multiplied by 15 as well.

	A	B	C	D
1			2	30
2			4	
3			6	
4			8	
5			10	

Should I choose the "No change" or "Relative change" option?

5. Assume the procedure in ex. 4 has been completed and Column D contains the following data:

	A	B	C	D
1			2	30
2			4	60
3			6	90
4			8	120
5			10	150

Indicate how the display would change as a result of using the ZOOM COMMAND.

HOMEWORK SOLUTIONS:

1. a) +B5*12
   b) +C1+6
   c) +X3/15
   d) +D41-32
   e) +2*J12+7

2. a) T14, AA14
   b) H5,L5,M5
   c) B2

3. a) C
   b) A,B
   c) A50
   d) 289
   e) 79

4. Relative change.

5. The numbers in column D would each be replaced by a formula. The display would be:
   +C1*15
   +C2*15
   +C3*15
   +C4*15
   +C5*15

CONSUMER MATHEMATICS

Introduction to the electronic spreadsheet (Appleworks)

LESSON: 5L

AIM: How can we prevent specific areas of the spreadsheet from scrolling out of view? Is there a way to rearrange our data by moving columns or rows to new positions?

PERFORMANCE OBJECTIVES: The student will be able to...

1. Use the TITLES COMMAND to freeze:
   - a) All rows at and above the cursor.
   - b) All columns at and to the left of the cursor.
   - c) Both columns and rows.
   - d) To return the spreadsheet to its default position.
2. Use the MOVE COMMAND to move data within the spreadsheet:
   - a) Move one or more columns to new column locations.
   - b) Move one or more rows to new row locations.
3. Review cursor manipulations:
   - a) Entering coordinates.
   - b) Pointing.
   - c) Moving right and up as opposed to left and down.
4. Work with the split spreadsheet:
   - a) Using two side by side windows.
   - b) Using a top and bottom window.
   - c) Using the Open Apple-J to move the cursor between windows.
5. Understand how Appleworks recalculates:
   - a) By order.
     - 1) Calculation by columns.
     - 2) Calculation by rows.
   - b) By frequency.
     - 1) Automatic calculation.
     - 2) Manual calculation.
6. Access the help screen:
   - a) For a brief review of the available commands.
   - b) To see the standard values currently in effect.

VOCABULARY: synchronize, unsynchronized

MOTIVATION:

- Have students load their original worksheet that they called MYGRADES. Have them display only the average column. Let them change computers and pose questions such as:
  - a) What is the highest average?
  - b) In what subject was the highest average achieved?
- Elicit the need to freeze specific areas of the worksheet.
  - a) A row or column that would not move out of view.
  - b) Moving the average row next to the subject row.
  - c) Splitting the worksheet in two parts, each one scrolling separately, so that any two rows or any two columns can be placed in an adjacent manner.

DEVELOPMENT:

1. The MYGRADES worksheet should be loaded in the computer and the need to fix the names of the subjects in place, so that they cannot scroll off the screen, should be established. Teach students that the TITLES COMMAND can only freeze rows at the top and columns to the screen's left. We cannot decide to freeze interior rows or columns. We can freeze row three, only if we freeze row one and two as well. We can fix column B by fixing column A as well. Positioning the cursor properly is vital to the correct execution of this command. Offer the following diagram to clarify instructions.

```
------------------------------------------

               FIXED ROWS

        X////////////////////////////
        \
        \
FIXED   \
        \
COLUMNS \      NON FIXED AREA
        \
```

THE PORTION OF THE DIAGRAM USED AS A DELINIATOR AND REPRESENTED BY "\,/, or X" IS PART OF THE NON FIXED AREA.

a) For fixing rows the cursor should be positioned in the row immediately below the rows that we wish to fix or the top row of the non-fixed area. This is indicated by the "/", in the diagram above.

b) For fixing columns the cursor should be positioned in the column immediately to the right of the column(s) we wish to fix, or the leftmost of the non-fixed area. This is indicated by the "\" in the diagram above.

c) For fixing both column(s) and row(s) the cursor should be positioned in the upper left hand cell of the non fixed area. The cell marked with the "X", in the diagram above.

d) We access this command with Open Apple-T, for TITLES. Our options are (Titles? Top Left side Both None) The "Top" option will fix horizontal rows, "Left side" will fix vertical columns. The "Both" option fixes both row(s) and left column(s), while the none option cancels any "fix" that was previously made.

e) Once Titles are fixed they will never scroll off the screen until they are removed. The cursor will move freely amid the non fixed area. If it becomes necessary to change a Title it can be edited in the following manner. When the cursor hits a Fixed region the "honk" is heard. The title region appears to double before your eyes. The image of the title region can be changed. When the image is changed the Title region is changed as well.

f) To fix the subjects in place position cursor anywhere in column B. Access TITLES COMMAND with Open Apple-T, choose "left side" option. We are only interested in fixing one column so there is no need to highlight any other column, just press return. This is all that is needed to prevent column A from scrolling off the screen. To fix the test numbers position the cursor anywhere in row 2. Access the TITLES COMMAND with Open Apple-T, choose "top" option and press return. Row one will remain in place at the top of the screen.

- Have students restore the worksheet to its original state with the "none" option and then fix both column A and row 1 with the "both" option.
- Students should be given a few minutes to scroll the screen up and to the right to impress on them the way the titles remain in place.

2. Appleworks MOVE COMMAND is used to reposition data on the spreadsheet. It is useful to have when rows or columns are inserted incorrectly and deleting or retyping data is too time consuming. The MOVE COMMAND is especially useful when only a portion of the spreadsheet is to be printed. For example, we wish to print only the subject and the average grade for each subject of the MYGRADES file. Assume the averages are in column I. The subjects are located in Column A. We have two options. We can move the subject next to the average or the average next to the subject. Because of FORWARD REFERENCE, which is

discussed later in this lesson, it is best to move the subjects. Remind students how column I was created. Position cursor in cell I2 and read the cell indicator line. Notice that the formula AVG(B2...H2) was used to created column I. When data is moved, many activities take place on the worksheet. Let students conjecture about the changes that will take place in the formula as a result of this move.

a) When we choose to move column A to column H we are moving our data to the right. Column A is temporarily deleted. All columns to the right are moved one column to the left, to fill the space vacated by A. My desired destination for A is to be H. The column that I specify as my destination will not move. I specify column I. Column I does not move. Every column to the left of I moves one column to the left. Column H is now empty. This is exactly what we wanted for now column A fills the vacated column H.

- Rule: When moving a column to the right. The destination column must be the column to the right of the desired location. If I choose column T as my destination I must specify column U. To move data from column H to column X the specific destination column is column Y.

- To move column A to column H:

1. Position the cursor anywhere in column A.
2. Access the command with Open Apple-M for Move.
3. Press Return to choose "within worksheet" as we did the the Copy Command.
4. Use the right arrow to choose the column option and press Return twice. (Since we are only moving one column there is no need to highlight more.)
5. Move the right arrow until the cursor reaches column I.
6. Press return and the data from column A will move to column H.

b) After this move has been made ask students what they think happened to the formula that was originally in column I. Remember it was the average of the grades in B through H. Now column H contains the subjects and the grades are located in columns A through G. Move the cursor to the average column and read the formula on the cell indicator line. If this move was correctly executed the Average column is still column I. Positioning the cursor over I2, the cell indicator line reads AVG(A2...G2). Elicit that Appleworks changed the formula from (B2...H2). Have students verbalize. After a column has been moved, all variables referencing cell locations are automatically changed to correspond to the coordinates of the new locations. Ask students if they think moving rows preserves formulas as well.

c) It is sometimes expedient to move columns to the left. This type of a move is used frequently when numerical calculations are not involved. Let us move column I to column B. We position our cursor anywhere in column I. As soon as we specify "I" as our "from column" it is emptied, but now the computer is signaled that the move is being made to the left. The data is "H" is pushed into "I" and the column that we specify as our destination must also move one column to the right. Thus to move column I to column B we specify "B" as our destination. The data in column B will be moved one column to the right. (Draw a parallel between this and the insert command which works in a similar fashion.)

- Rule: When moving data to the left, the destination column is specified as out desired location. Thus a move from "I" to "B" would result in our specifying "B" as our destination.

- To move column I to column B.
  1. Position the cursor anywhere in column I.
  2. Press Open Apple-M, Return.
  3. →, Return, Return.
  4. Use left arrow to move cursor to column B, press Return.

d) More than one column can be moved at once. We highlight all the columns that we wish to move as we did with the BLANK, INSERT, or DELETE COMMANDS. When moving to the right we move the cursor to the column to the right of the desired destination of the last column in the block that is being moved. When moving to the left our destination is the column that we wish to move our first column into.

e) Rows can be moved up or down in blocks or singly. Moving rows down is similar to moving columns to the right. This time we position our cursor below our desired destination instead of to the right of it. To move row 6 to row 60 we first position our cursor anywhere in row 6 and then point our cursor to row 61. When moving rows up we observe the same rules as we used to move columns to the left. Our destination column is now our desired location. To move row 100 to row 89, we position our cursor in row 100 and then point it at row 89.

f) Have students move the Math grades to the row below the Typing grades and then move the Typing grades to the row below the English grades. Elicit that formulas are still preserved and reword our former rule to read "After a row or column has been moved...". Remind students that after they learn to print their worksheets (next lesson) they will find many uses for the move command.

3. The fact that formula references are changed as a result of the MOVE COMMAND causes the spreadsheet to continually recalculate after every move. Students experimenting with the spreadsheet may, in a rare instance, find that an incorrect answer is displayed. An understanding of

the way the spreadsheet calculates is important if a correct explanation of why this type of error can occur is to be given. The following notes are recommmended for teacher use only, or as enrichment for those students who will benefit from this discussion. First, a few informal definitions:

- Circular reference: Assume B10 is an empty cell. Position the cursor over B10 and type +B10+5. First a five appears in B10 because when a cell is empty Appleworks assumes it contains a zero. Next a ten flashes in B10 as we realize that the spreadsheet is recalculating. Force another recalculation by pressing Open Apple-K. The value will change to a 15 because the cell now contains a 10 and is no longer empty. In fact with every recalculation (Open Apple-K) you force, the entry in B10 will be stepped 5 units.
- Forward reference: When you plan the worksheet attention must be given to the position of a formula that references other locations. These formulas must be placed in a location that is calculated after the referenced locations have been calculated. We have already discussed the default calculation by columns and the option, calculating rows first. If the sheet is set up to calculate by columns, calculations begin in cell A1 work down column A move on the B1, work down column B and continue in this manner, calculating down each column until the last cell has been reached. Our formulas must be placed either below the cells they reference or to the right of the cells they reference. If we have changed to row first calculation then Appleworks begins to calculate in A1 and continues along the first row, calculating B1, C1, etc. until it comes to the end of the row. It then resumes calculations in A2 and completes the second row. Each row is then calculated in order until the very last cell is reached. Formulas must be placed in the row below the referenced location, or in a cell to the right, if using the same row. Consider the following example:

	A	B	C
1		+C1	+A1+3
2		+C1	

If you place a 5 in A1, C1 will become 8. B1 and B2 will be calculated before C1 becomes 8 and their value will depend on the value that was previously in C1. If we change to "row first calculations", B2 will be correct because it is calculated after C1. B1 is an example of what we mean when we caution users to be alert to forward reference. Thus students experimenting with the MOVE COMMAND may find errors with the spreadsheet's calculations. If these errors cannot be corrected by:

1) Changing the order of calculation (to row first).
2) Forcing a recalculation with Open Apple-K.

Then look for forward referencing. Explain to students that their answer is being calculated before one of the numbers in the example has been calculated.

4. The WINDOW COMMAND is used when columns or rows are too wide apart to appear on the same screen and the user finds it necessary to look at one, while working with the other. The students may want to reposition the data by using the Move Command. Have students understand that the Move Command is used for a more permanent type of change. The WINDOW COMMAND is used for a temporary change. If they suggest the TITLES COMMAND remind students that only top or extreme left rows can be frozen with the TITLES COMMAND. Windows can be created anywhere on the spreadsheet. Splitting the screen into two windows provides for more flexibility than either the TITLES or the MOVE COMMAND. Distant rows or columns can be compared, inspected, or examined. Formulas positioned far from their data can be viewed as data is changed. To access this command we type Open Apple-W for Window. The options are:

1) Side by side: A vertical line drawn on the spreadsheet transforms it into two windows that appear to be side by side. The vertical line contains the row numbers that benefits clarity.

2) Top and bottom: a horizontal line drawn on the spreadsheet transform it into two windows that are one under the other. The horizontal line contains the column designations and there is no difficulty determining what column you are viewing. The windows need not be symmetrical. The dividing line can be placed anywhere the user desires.

   a) Choosing side by side. Let us assume all columns are the default column width of 9. The full screen displays 8 columns A - H. I have entered a customer number in column B and I wish to keep this number visible while I examine the customer account. I decide to split the worksheet with a vertical line and place the window between column B and C. The cursor must be positioned in column C, the left boundary of the righthand window. The result is a two column lefthand window and a five column righthand window.

   b) To split the worksheet with a horizontal line I choose the top row of the bottom window for my cursor position. If my top window is to contain five rows I position the cursor in any cell in the sixth row before I access the window command.

   c) Once the spreadsheet has been divided into two windows we can only work in one window at a time. The cursor remains where you positioned it to divide the sheet. That is, it is either in the right window or the bottom window. The position of the cursor determines the window that we work in. Let's create a window by placing a horizontal line above the seventh row. Position the cursor in row 7 and press Open Apple-W. Use the right arrow to choose the "Top and Bottom" option. As soon as you press return a horizontal line appears between rows 6 and 7. The cursor is positioned in the bottom window. The arrow keys will cause the bottom window to scroll up and down, right and left. The top window remains unchanged. It is possible to see column A on top of column J. The cursor can be jumped across the window boundary with the Open Apple-J (JUMP COMMAND for Windows). When these keys are pressed the cursor will pass to the top window and this top window will scroll when the arrows are moved while the bottom window remains stationary and unchanged.

5. In most cases we will want our windows to scroll together in a synchronized fashion. If the left window displays rows 19 through 36 and the data in the right window are in rows 1 through 18, we have defeated our original purpose. We wanted to be able to view our customer accounts, but they are no longer adjacent to the customer number. To correct this I must choose the synchronized option of the Window command. This is only available when the worksheet is already split. It is accessed by pressing Open Apple-W a second time. (Remember the first time Open Apple-W was pressed we entered the window command and choose to split the screen vertically or horizontally.) After the second Open Apple-W is pressed we see the following display on the bottom line.
   (Windows? One Synchronized)

- If you choose One you are returned to one window and the spreadsheet is no longer divided. This is the option we will use to clear the spreadsheet of its window.

- Choosing synchronized will insure that both windows scroll together. If they are split with a vertical bar the row numbers will be the same in both windows at all times. You will be able to place any two columns in an adjacent fashion on either side of the vertical divider and be confident that the same row is being viewed. If you choose to split the screen horizontally, you are assured the columns will be the same if the synchronized option is selected. Now you can place any two row numbers next to each other, above and below the dividing window.

- Try the following sequence.
  1. Position cursor at L5.
  2. Press Open Apple-W, Return (to choose side by side).
  3. Press Open Apple-W, →, Return (to choose synchronized).
  4. The worksheet is now divided by a vertical bar into a three column left window and a four column right window. The cursor is in the right window. Depress the down arrow and hold it down. Watch the row number scroll together.
  5. Press Open Apple-W (since this is the third time you will see a new display).
     (Windows? One Unsynchronized)
  6. Press →, Return (to choose unsynchronized).
  7. The cursor is still in the right window. Depress the down arrow and hold it down. Now only the right window will scroll. The left window remains unchanged.

- Ask students to guess that the display will be if they press Open Apple-W a fourth time. This answer is:
  (Windows? One Synchronized)
  Depressing the Open Apple-W will toggle between the second and third displays as long as the screen is split.

6. An extra special feature of Appleworks is the HELP COMMAND, accessed by pressing Open Apple-? at any time. This feature changes the current video display into a help screen. The information on the screen reviews the various spreadsheet commands and explains their use and options. At the end of the help screen is a list of standard values currently in effect. When the spreadsheet is first turned on these standard values will be all of Appleworks default values. If the user changes these standard values in the course of creating a document, these changes are reflected on the help screen. Thus if the user wishes to determine the standard values that are in effect at any given time, they may be viewed at the bottom of the "Help Screen".

APPLICATIONS:

1. Create a worksheet that displays the results of a class charity drive. Include student name and daily amounts collected for a one week period. Freeze the student names and the names of the weekdays.
- Calculate daily Sums, using the built in function, as well as Sums by student name.
- Find a grand total for the class.

2. Unfix the Titles.
- Move the student names next to the total amount they collected.
- Interchange Tuesday and Thursday and see the formulas reference the new locations.

3. Use the move command to separate the boys and the girls. Make sure that all are grouped together according to sex.

4. Use the window command to separate the students according to sex. Find new totals and fix Titles in place again.

5. Use the replicate command to fill the first three columns with ten ones, ten twos and ten threes respectively. Use the move command to move the columns from A, B and C to X, Y and Z back to L, M and N.

SUGGESTIONS FOR LAB SESSIONS:

- An exercise changing fractions to decimals and percents can be very useful to students. This affords an opportunity to review the Copy, Insert, and Titles Command, as well as the different label and value formats.

a) In the first 10 rows of column A enter numbers one through ten.
b) Position the cursor in column C and divide each cell in column A by ten, using the copy command to speed calculations.
c) Copy column C into column D with the copy command and the No Change option.
d) In column B use the " to indicate a label and enter 1/10, 2/10, 3/10...10/10 in each row.

e) Insert a row at the top and label column B FRACTION, column C DECIMAL, and column D PERCENT.

f) Fix the titles.

g) Format column C to the special value format FIXED with 2 decimal places.

h) Format column D to the special value format PERCENT with 0 decimal places.

- Repeat the same procedure with thirds, eighths, sixths, any number.
- Save the worksheet so that it may be printed.

SUMMARY:

1. What does the Titles Command do?
2. Can we fix more than one column? More than one row?
3. Is it possible to fix rows 1,2, and 3 as well as column A, all at the same time? (Yes)
4. Can column B be fixed with row 1? (No)
5. Into how many windows can the spreadsheet be split? (Only two.)
6. How can I cause a left and right window to scroll together?
7. What happens when I choose option one of the Window Command?
8. How can I move the cursor between windows?
9. If I wish to move column B to column K, what column must I specify as my destination column?
10. To move row 5 to row 50, what row is specified as my destination row?
11. Is my destination always specified by one row after my desired location? (No, when moving up or to the left we specify our desired location.)
12. Where can I find the standard values currently in effect?
13. Are these standard values always Applesoft's default standards? (No, they are the ones currently in effect.)

HOMEWORK:

1. Where must I position the cursor:
   a) To fix the titles in the A and B columns?
   b) To fix the titles in row 1?
   c) To fix the titles in the A column and in the first two rows?
   d) To create a side by side window between columns F and G?
   e) To create a top and bottom window between rows 16 and 17?

2. a) What column must be indicated as my destination column if I wish to move column A to column K?
   b) What row must be specified as my destination row if I wish to move row 16 to row 25?

3. How do I move the cursor between windows?

4. Cell A1 contains the value 14. What values will Appleworks assign to the following cells as a result of entering the following formulas?
   a) Cursor over B1, 5*A1.
   b) Cursor over C1, +A1+22.
   c) Cursor over D1, +A1-9.
   d) Cursor over E1, +C1/9.
   e) Cursor over F1, +E1*D1.

5. Consider the following spreadsheet display:

	A	B	C	D	E	F	G
1	75	68	84	78	82	81	78
2	71		75	72	73	77	
3	82	80			95	94	
4	80	79	78		80	81	
5	100					68	

G1 (value) AVG(A1...F1)

The cell indicator line displays the formula in G1. I wish to replicate this formula with relative change in (G2...G5). Find the values in G2,G3,G4,G5 as a result of this replication.

HOMEWORK SOLUTIONS:

1. a) Anywhere in column C.
   b) Anywhere in row 2.
   c) B3.
   d) In column G (upper left corner of right window).
   e) In row 17 (top row of bottom window).

2. a) Column L.
   b) Row 26.

3. The Window Jump Command, Open Apple-J.

4.

	A	B	C	D	E	F
1	14	70	36	5	4	20

5.

	G
1	78
2	73.6
3	87.75
4	79.6
5	84

CONSUMER MATHEMATICS

Introduction to the electronic spreadsheet (Appleworks)

LESSON: 6L

AIM: How can we use the printer to prepare a hard copy of our spreadsheet?

- How do we prepare a diskette to receive and save our data?

PERFORMANCE OBJECTIVES: The student will be able to...

1. Use the PRINT COMMAND to make a hard copy of the spreadsheet.
2. Prepare a neat and orderly format for the printed form by using:
   a) Appropriate margins.
   b) Proper spacing.
   c) Adjust paper width.
   d) Adjust characters per inch.
3. Select an appropriate title and print it on the worksheet.
4. Explain the reason for initializing new diskettes.
5. Use the Main Menu of the Appleworks spreadsheet to:
   a) Initialize a new diskette.
   b) Delete files from the disk.

VOCABULARY: hardware, software, hard copy, initialize a disk, format a disk, customize, compatible, report

MOTIVATION:

- How are diskettes prepared for receiving and saving our data?
- Is a diskette the only way to save our worksheet?
- What is the meaning of the word "hard copy"?
- How do we print the worksheet?
- Must we print the entire spreadsheet or can selected areas of the worksheet be printed?
- How do we use the printer and what are some of the printer options available to us?

DEVELOPMENT:

1. Show students a new box of disks and tell the class that the disks were just purchased. Ask the question: "Can we take one of the disks out of the box, put it in the computer and use it as a data disk to save our files"? Elicit the need to initialize the diskette. Appleworks uses the phrase, format a blank disk. Tell students that this process prepares disks in the following ways.
   a) It puts the Disk Operating System (DOS) on the disk. For Appleworks the operating system is called PRODOS. Tell students that as a result of this type of preparation the formatted disk can only be used with operating systems that are compatible with PRODOS. It cannot be used in an IBM computer or an ATARI, a RADIO SHACK or with CPM programs. It is like trying to put a three pronged plug into a two pronged socket.
   b) A guide named the Volume Table Of Contents and called the "VTOC" is also placed on the disk. This guide enables us to find and retrieve our files. Think of this VTOC as a road map. Highways and cross streets enable us to find our way to various parts of the disk.
   c) The track and sector markers that are placed on the disk can be read by the computer programmers. For our purposes we can think of these track and sector markers as street signs and highway indicators.

2. Have students format a disk. Tell them that they can erase the contents of an old disk by this process as well. Caution them to make sure the disk in the drive is the one that they want formatted. Suggest that this be done with all other disk drives empty, as a precaution. Remember a computer is simply a piece of electronic equipment and while very reliable, it is just a machine. Remind students how many of their precious files are on these data disks and how much hard work would have to be put forth to recreate all these files. Losing the program disk could be another possible disaster. Think of the cost involved in replacing the software. To

format a blank disk choose option 5 of the Main Menu and press Return. You will see the Other Activities Menu on the screen. Choose option 5 again and The Disk Formatter Menu appears on the screen. In the upper left hand corner of the video display is the drive number of the disk drive that will hold the blank disk, the one to be formatted. The display prompts the user to give the disk a name. The name must begin with a letter and contain a maximum of 15 characters. These characters may be numbers, letters or the period. After you enter the name, press return. Make sure the blank disk is in the specified drive. You can, as a precaution, remove the Appleworks disk. To begin the formatting process, press the space bar. The drive whirs and clicks, the screen reads FORMATTING. When the red light on the drive goes out, and the screen reads SUCCESSFULLY FORMATTED, we know the job has been accomplished.

3. Saving our files on disks is one way of preserving our data. Are there any other ways? Elicit the need for the PRINT COMMAND. Teach students the phrase hard copy. When we save our files on a disk we say we are creating a soft copy. When we use the Appleworks program we say we are using software. When we print a copy of our files we say we are creating a hard copy. The hardware that we are using is called a printer. The computer, the drives and the monitor are other examples of hardware. The following is a definition taken from Websters' New World Computer Dictionary.

- Hard copy: computer output that is printed on paper and can be read and handled by people: a hard copy is opposed to other computer output that may be temporarily displayed on a terminal or recorded on another medium such as magnetic tape.

To print the files on the printer it is important that the printer be turned on. Make sure students are aware of all that is necessary to know about turning on the printer. For most printers there is an on/off switch and a select button as well. It is not necessary to initialize the printer (PR#1). The Appleworks program will give the printer the proper signal when we access the PRINT COMMAND. IF for some reason the Printer is off, or not selected, the program will halt execution.

4. Before we can think of printing our worksheet we must know certain things about the paper we are using. Most printer forms provide room for 80 characters of normal print mode in the width and 66 lines of print in the length. Appleworks lets us customize the reports we print. The process of printing a worksheet is called printing a report. Deciding how much room to leave for the margins on the top, bottom and sides, or whether to single, double or triple space the lines, is the process know as customizing the report.

- Note to teacher: Appleworks also provides options that permit you to customize the spreadsheeet for the particular printer that you are using. To access these options choose "Other Activities" from the main menu (option 5) and then "specify information about your printer(s)" (option 7). The act of customizing the software for your particular printer is menu driven and easy to follow. If your printer is not listed use the custom option. You can work with up to three different printers if available. You can change type, print compressed or enlarged, or use emphasized mode. This is done by sending special characters to the printer. The correct characters can be found in your printer's manual. All special codes to the printer must be terminated with a caret " ". If you press Escape or Return Appleworks thinks this is part of the message that you are sending to the printer. When all else fails resort to trial and error. You will know you need a line feed if when attempting to print, your printer never advances a line but passes back and forth over the same line. Top of page commands are generally titles and page numbers. Printers that are equipped with form feed are generally capable of stopping at the end of a page. Unless your printer has an extra large carriage the planten width is 8.0 inches.

5. To enter the print command press Open Apple-P. The display on the bottom line is:
   (Print? All Rows Columns Block)
   If you choose all the entire spreadsheet will be printed. By now students will be familiar with the selection of rows, columns and block and the cursor movements that highlight the desired area. Caution students to be very careful with the width of the spreadsheet. If you are attemting to print 10 columns of 9 characters each you will have a serious problem. 90 characters is much too wide to display on a standard 80 column printer. One way to solve this problem is to press escape and return to the Review/Add/Change mode of the spreadsheet. You can now adjust column widths. If not too much data is included in each column they can all be changed to 7 characters each. Ten columns of 7 characters each is only 70 characters and still leaves some room for side margins. Appleworks default is 10 characters per inch. We can divide that inch into two 1/2 inch margins at the right and left or .2 at the right and .8 inch at the left. Another adjustment might be to change 7 of the columns to 5 characters each while the 3 others remain at 10. This gives us 65 characters to work with and we can plan slightly wider margins. The need to plan the report in advance must be stressed at this point. For advanced planning it is necessary to know how the paper is divided in terms of inches, the number of characters per inch and number of lines per inch.

6. Appleworks calculates margin width in tenths of inches. The default for all margins is 0.0. If you want a margin you must specify it or the default will be in effect and you will have no margin.
   a) You have the option of changing characters per inch. The default is 10 characters per inch. You can select any number form 4 up to and including 24. This number must be compatible with your printer. The default planten width is 8.0. This is fairly standard for all printers.

Have the students calculate the layout in the following manner.

Planten Width
- Sum of the left and right margins

Line Width

Suppose we choose left and right margins of .8 inch (they need not be equal). The subtrahend in the above example becomes 1.6. The minuend will be constant at 8.0. The line width can now be calculated by finding the difference.

8.0 - 1.6 = 6.4

Thus our line width is 6.4 inches. If we plan to use the default characters per inch (10) we can easily calculate the characters per line in our heads. We will set down an example for clarity.

Line width	6.4
X Characters per inch	X 10
Characters per line	64

How many characters per line would result if we changed the default and used 15 characters per inch (96).

b) Next, we must consider top and bottom margins. Our default paper length is 11 inches. The default lines per inch is 6, thus yielding 66 lines per page. Appleworks gives you the option to change the lines per inch to 8 (check to see if this is compatible with your printer). The formulas that we will use for these calculations are:

Paper length
- Sum of top and bottom margins

Printing length

Printing length
X Lines per inch

Lines per page

Appleworks default spacing is single spaced. This can be changed to double or triple spaced. The number of lines per page that you will need is determined by counting the number of rows to be printed and the number of spaces to be included. Assume we want to print 24 rows, double spaced. 24 rows + 24 spaces = 48 lines. With 6 lines per inch we need 8 inches of printing space. This gives us 3 inches of available space to divide among the top and bottom margins.

c) The final option to be considered before printing a worksheet is the heading. You can include the date and the filename. If you choose this option the Filename that appears on the top of the worksheet and current date entered will appear on the top of the report.

7. After the report has been carefully planned you can enter the options that you selected by accessing the PRINTER OPTIONS COMMAND with Open Apple-0. This is done while still in Review/Add/Change mode. The menu of printer options list all the default value that have not been changed by the user. The current filename is displayed in the top left corner and pressing escape will return you to Review/Add/Change mode. You are prompted to type a two letter option code. These codes are found to the immediate left of the various options. For example:

- We see (LM: Left Margin), If you type LM you are prompted to enter the desired width of the left margin, (1.1 for example).
- If we type TS the default single spacing changes from single space to triple space.
- (PH: Print report header at top of page NO), if we type PH the "NO" will change to "YES" and the report will have a heading of the filename and the current date.

8. Appleworks includes an option to change the filename. Sometimes this is used before a report is printed. If the current filename does not suit the report a change can be made quite easily. By pressing Open Apple-N you

will be prompted to type a new Filename. Observe the same rules for legal filenames and a new filename is attached to your file. If you save the spreadsheet with the new filename then it is possible to have two identical files with different names. This wastes valuable space on the disk. If you suspect that this has occurred check both worksheets and see if they are in fact identical. Decide which speadsheet you wish to eliminate from the disk. We call this process deleting a file from the disk. Do not confuse this with deleting a row or column, or deleting a file from the desktop. This will erase the filename from the disk and it will be impossible for you to find it to reload it. Think very carefully before you make a decision to delete a file from the disk. (More on deleting files from disks later.)

9. Permit students to print some of their worksheets.
    a) Use the Open Apple-H command to print what you see in front of you on the video screen. This can be used to give students copies of the various menus and help screens. (There are two help screens that the spreadsheet accesses with Open Apple-?. The first one from the Main Menu discusses the various keystrokes and the second one from the spreadsheet discusses the various commands.) This type of printing is sometimes referred to as a screen dump.
    b) Use the Open Apple-P and type the entire spreadsheet or specific rows, columns, or block. The files that the class has been saving can now be recalled and printed. Since only adjacent rows and columns can be printed the MOVE COMMAND is suggested.
    c) The Open Apple-O which is used to format a neat report should be used in conjunction with the Open Apple-P. Reports should be printed in all three suggested ways and compared as to use, value and appearance.

10. Files are deleted from disks by first choosing option 5 of the Main Menu and then option 4 of the "Other

Activities Menu" (Delete files from the disk). This brings the Delete file Menu to the screen. The files that are currently on the disk are listed and both available and used space is noted. You choose the file that you wish to delete in the usual fashion. The down and up arrow to move the cursor, the right and left arrow to select and erase. When you have made your selection press Return. You are given a second chance. Appleworks is asking you if you really want to delete this file. If you are sure choose "yes". After the file is deleted you are returned to the Other Activities Menu.

APPLICATIONS:

1. It is now time to print all the files we have been creating and saving since we began learning how to use the spreadsheet.

- An inspection of the MYGRADES file reveals 9 columns of 9 characters each or 81 character per line. The file must be redesigned:
  Suggestion: Each test column to be 5 characters, eliminate the space in the label and rename Testl, etc. (7X5=35). Average column to have 6 characters and Subject column the default 9. 35 + 6 + 9 = 50.
  50/10cpi = 5 inches
  8 - 5 = 3 inches for side margins.
  Leave one and one half inch margins at the side, two inches at the top and use double spacing. Changing the name to ClassGrades and print.

2. The multiplication table and the sheet of fractions, decimals and percents can be printed at this time. These tables can be pasted in student notebooks. Large groups of data can be transformed into hard copy if printed in compressed mode and single spaced.

3. Students should have experience deleting files from data disks. Nonsense files can be created quickly and saved. This will afford practice deleting files. Make sure the correct disk drive is in effect and observe all the precautions outlined in the lesson, before any files are deleted.

4. Blank worksheets can be created using Open Apple-H. Bring the spreadsheet to the video terminal and make sure it is cleared. Press the Open Apple-H and produce a hard copy of the spreadsheet. This can be duplicated and used to plan future reports and spreadsheets.
5. A copy and explanation of the spreadsheet commands which has been taken from the Appleworks Manual is included for review. This sheet can be duplicated for each student. If time permits students can make their own.

SUGGESTIONS FOR LAB SESSIONS:

- If the printers are available to the students then there are many activities that will give them the necessary practice.
  - a) Creating reports (school).
    1. Students program.
    2. Student report card.
    3. Daily schedule.
    4. Special room directory.
    5. Vocabulary lists.
  - b) Creating reports (home).
    1. Names and addresses.
    2. Allowances, earnings and budget.
    3. Phone list.
    4. Library lists.
    5. Projected vacation costs.
    6. Mileage charts.
- Students must be encouraged to preplan the report. Discussing the size of various fields can be very helpful. Questions such as:
  How many characters will I need in a last name field? A first name field? A field that contains a grade? A phone number? A zip code?
  Will be helpful to students when planning the report. Spacing must be taken into consideration. If each field is packed with characters then words will fuse together and the report will be unclear.

- Discuss how to format the following report. Last name, First name, official class, 6 tests, 1 average column.

SUMMARY:

1. Where can I find a soft copy of a file that I created? (On a disk or a video display.)
2. Why is printed computer paper called a hard copy?
3. Can you name three types of computer hardware?
4. Is a spreadsheet program an example of hardware or software?
5. Why do we initialize blank disks?
6. What happens to a used disk when it it formatted by the Appleworks program?
7. What is the planten width of our printer?
8. How many characters can be printed on one line?
9. What is the default lines per page?
10. My printer gives me 17 characters per inch. Would the characters look smaller or larger then our default 10 characters per inch?
11. How many characters could be printed on an 8 inch piece of paper (with 17 cpi)?
12. Do all margin widths have to be the same?
13. What are the restrictions placed on the margin widths.
14. How do we access a text screen dump?
15. What do we use the Open Apple-O for?

HOMEWORK:

1. Describe in your own words what is meant by the following phrases.
   a) Making a hard copy.
   b) Creating software.
   c) Making a soft copy.
   d) Taking inventory of the hardware.
   e) Customizing a report.

2. How much room will I have for side margins if I wish to print 15 columns of 5 characters each using the default cpi?

3. How are new disks formatted?

4. How are old files deleted from the disk?

5. Name the keystrokes you would use to access the command that will:
   a) Change the filename.
   b) Format a report.
   c) Print the report.
   d) Make a copy of the Main Menu.
   e) Right justify a title.
   f) Edit a formula.
   g) Replicate a column.

HOMEWORK SOLUTIONS:

1. a) Printing a report on paper.
   b) Writing a computer program.
   c) Saving a file to a disk or loading a file to a monitor.
   d) Cataloging printers, computers, drives, monitors.
   e) Determining column widths, margins, spacing, titles.

2. One half inch.

3. Option 5 of both the main menu and the other activities menu.

4. Option 4 of the other activities menu.

5. a) Open Apple-N.
   b) Open Apple-O.
   c) Open Apple-P.
   d) Open Apple-H.
   e) Open Apple-V or L.
   f) Open Apple-U.
   g) Open Apple-C.

APPLEWORKS QUICK REFERENCE

KEYWORD	KEYSTROKE	SPREADSHEET
Arrange	O - A	Arrange or sort rows.
Blank	O - B	Blank out cells.
Copy	O - C	Copy entries.
Delete	O - D	Delete columns or rows.
Edit, Cursor Switch	O - E	Switch between insert and overstrike cursors.
Find	O - F	Find entries or text.
Group	O - G	NA
Hard Copy	O - H	Print hard copy of current screen display.
Insert	O - I	Insert rows or columns.
	O - J	Jump to other window.
Calculate	O - K	Recalculate values.
Layout	O - L	Change cell layout.
Move	O - M	Move rows or columns.
Name Change	O - N	Change name of file.
Options, Printer	O - O	Display printer options.
Print	O - P	Print worksheet.
Quick Change	O - Q	Switch to another file on the desktop.
	O - R	NA
Save	O - S	Save the current file to disk.
	O - T	Set titles.
	O - U	Edit cell contents.
Values	O - V	Set standard values.
Window	O - W	Create windows.
Clear	O - Y	Clears to end of cell.
Zoom	O - Z	Zoom to formula display.
Ruler	O - 1 . . O - 9	Move within file to beginning(1), end(9), or proportionally(2-8).
Help	O - ?	Display help information.
Cursor Move	O - ← or O - →	Scroll horizontally one screen display.
Cursor Move	O - ↑ or O - ↓	Scroll vertically one screen display.

VISICALC
TEACHER'S GUIDE

The introductory lessons are designed to give students a familiarity with the power of an electronic spreadsheet. We do not aim to make the student proficient in all the material presented. Suggestions for lab sessions are included in each lesson in the event that time is available. The more hands on experience the students have the faster they will master all the techniques presented. Ample practice will be provided throughout the course. Most units include computer applications. In the lessons that follow we will expand on the techniques introduced in the first six lessons. It may sometimes become necessary to refer to these introductory lessons to review a particular function or technique. The use of the VisiCalc manual, if available, is also recommended.

The Guide that follows lists the lessons that use the indexed commands, techniques and functions.

Built in Functions:		Introduction	Lesson 2L	Development 3
	Atan:	Indirect Measurement and Trigonometry	Lesson 8L	Development 6
	Average:	Introduction	Lesson 2L	Development 3
		Tables, Charts and Graphs	Lesson 4L	Development 2
	Count:	Introduction	Lesson 2L	Development 3
	Maximum:	Introduction	Lesson 2L	Development 3
		Earning A Living	Lesson 12L	Development 7
	Minimum:	Introduction	Lesson 2L	Development 3
	Pi:	Math in the Home	Lesson 12L	Development 3
	Square root:	Calculators	Lesson 2L	Development 4
	Sum:	Introduction	Lesson 2L	Development 3
		Earning a Living	Lesson 6L	Development 2
		Leisure	Lesson 1L	Development 5
		Leisure	Lesson 15L	Development 3,4
		Managing Money	Lesson 5L1	Development 4
		Math in the Home	Lesson 3L	Development 3
		Math in the Home	Lesson 12L	Development 6
	Tan:	Indirect Measurement and Trigonometry	Lesson 8L	Development 6

Change Filename:	Earning a Living	Lesson 10L	Development 5
	Earning a Living	Lesson 17L	Development 4
Changing Type Styles:	Introductory	Lesson 6L	Development 5,7
	Managing Money	Lesson 5L1	Development 6
	Managing Money	Lesson 5L2	Development 7
Circular Reference:	Introduction	Lesson 5L	Development 3
	Calculators	Lesson 8L	Development 3,6
Column Width:	Introduction	Lesson 3L	Development 6
	Managing Money	Lesson 5L1	Development 2
COMMAND:			
Blank:	Introduction	Lesson 2L	Development 6
	Leisure	Lesson 1L	Development 5
	Leisure	Lesson 17L	Development 4
	Math in the Home	Lesson 3L	Development 3
	Tables, Charts and Graphs	Lesson 3L	Development 5
Clear:	Introduction	Lesson 2L	Development 7
	Leisure	Lesson 1L	Development 5
	Tables, Charts and Graphs	Lesson 31	Development 5
Delete:	Introduction	Lesson 6L	Development 10
	Earning a Living	Lesson 10L	Development 2,3
	Indirect Measurement and Trigonometry	Lesson 8L	Development 4
	Leisure	Lesson 1L	Development 2
	Math in the Home	Lesson 3L	Development 3
	Tables, Charts and Graphs	Lesson 4L	Development 2
Edit:	Introduction	Lesson 1L	Development 12
	Introduction	Lesson 4L	Development 7
	Managing Money	Lesson 14L	Development 3,6
	Math in the Home	Lesson 3L	Development 1
Format:	Introduction	Lesson 3L	Development 2,3
	Earning a Living	Lesson 6L	Development 3
	Leisure	Lesson 17L	Development 2
	Managing Money	Lesson 5L1	Development 2
	Math in the Home	Lesson 19L	Development 2,3
	Tables, Charts and Graphs	Lesson 3L	Development 2,3
	Tables, Charts and Graphs	Lesson 4L	Development 2
Global:	Introduction	Lesson 3L	Development 4,5
	Calculators	Lesson 2L	Development 7
	Leisure	Lesson 18L	Development 6
	Managing Money	Lesson 5L1	Development 6
	Managing Money	Lesson 5L2	Development 3
	Managing Money	Lesson 14L	Development 7
	Managing Money	Lesson 16L	Development 5
	Math in the Home	Lesson 12L	Development 5

Insert:	Introduction	Lesson 2L	Development 5
	Calculators	Lesson 2L	Development 6
	Earning a Living	Lesson 12L	Development 3
	Earning a Living	Lesson 17L	Development 1
	Managing Money	Lesson 5L1	Development 5
	Tables, Charts and Graphs	Lesson 4L	Development 2
Move:	Introduction	Lesson 5L	Development 1
	Leisure	Lesson 1L	Development 5
Print:	Introduction	Lesson 6L	Development 3
	Calculators	Lesson 2L	Development 9
	Leisure	Lesson 1L	Development 6
	Leisure	Lesson 18L	Development 7
	Managing Money	Lesson 16L	Development 6
	Tables, Charts and Graphs	Lesson 3L	Development 4
Repeating Label:	Calculators	Lesson 2L	Development 8
	Leisure	Lesson 18L	Development 5
	Managing Money	Lesson 5L1	Development 5
	Managing Money	Lesson 14L	Development 5
	Math in the Home	Lesson 3L	Development 2
	Managing Money	Lesson 12L	Development 2
	Tables, Charts and Graphs	Lesson 3L	Development 2
Replicate:	Introduction	Lesson 4L	Development 1-6,8
	Calculators	Lesson 2L	Development 2
	Calculators	Lesson 11L	Development 4
	Earning a Living	Lesson 10L	Development 1
	Earning a Living	Lesson 12L	Development 2
	Earning a Living	Lesson 17L	Development 2,3
	Indirect Measurement and Trigonometry	Lesson 8L	Development 3
	Leisure	Lesson 17L	Development 2
	Leisure	Lesson 18L	Development 3
	Managing Money	Lesson 5L1	Development 3
	Managing Money	Lesson 14L	Development 2-4
	Managing Money	Lesson 16L	Development 4
	Math in the Home	Lesson 3L	Development 5,6
	Math in the Home	Lesson 12L	Development 3,4
	Math in the Home	Lesson 19L	Development 2
	Tables, Charts and Graphs	Lesson 3L	Development 2
	Tables, Charts and Graphs	Lesson 4L	Development 2
Storage:	Introduction	Lesson 1L	Development 1
	Indirect Measurement and Trigonometry	Lesson 8L	Development 3
	Leisure	Lesson 1L	Development 2
	Managing Money	Lesson 5L1	Development 7
	Managing Money	Lesson 14L	Development 7
	Math in the Home	Lesson 3L	Development 3
	Math in the Home	Lesson 19L	Development 5

Titles:	Introduction	Lesson 5L	Development 1
	Earning a Living	Lesson 6L	Development 1-3
	Tables, Charts and Graphs	Lesson 3L	Development 6
Window:	Introduction	Lesson 5L	Development 4,5
	Math in the Home	Lesson 19L	Development 7,8
Delete Files:	Introduction	Lesson 6L	Development 10
	Earning a Living	Lesson 10L	Development 3
Error:	Introduction	Lesson 3L	Development 10
	Leisure	Lesson 17L	Development 4
Exit Program:	Introductory	Lesson 6L	Development 10
Filenames:	Introduction	Lesson 1L	Development 1
Forward Reference:	Introduction	Lesson 5L	Development 3
	Calculators	Lesson 8L	Development 3
GO TO:	Introduction	Lesson 2L	Development 2
Initializing Diskettes:	Introduction	Lesson 6L	Development 1,2
Label Formats:	Introduction	Lesson 3L	Development 2
	Tables, Charts and Graphs	Lesson 4L	Development 1
Load Files:	Introduction	Lesson 2L	Development 1
	Earning a Living	Lesson 10L	Development 2
	Earning a Living	Lesson 17L	Development 1
	Leisure	Lesson 1L	Development 3
	Managing Money	Lesson 16L	Development 2
	Tables, Charts and Graphs	Lesson 4L	Development 2
Order of Operations:	Calculators	Lesson 8L	Development 1-5
Pointers:	Calculators	Lesson 11L	Development 3
	Managing Money	Lesson 5L1	Development 3
Rounding Values:	Calculators	Lesson 2L	Development 5
	Earning a Living	Lesson 10L	Development 6,7
	Tables, Charts and Graphs	Lesson 4L	Development 2
Recalculation:	Introduction	Lesson 3L	Development 7
	Tables, Charts and Graphs	Lesson 4L	Development 4
Spreadsheet Size:	Introduction	Lesson 1L	Development 1
Value Formats:	Introduction	Lesson 3L	Development 3,4
	Math in the Home	Lesson 19L	Development 3
	Tables, Charts and Graphs	Lesson 3L	Development 1

CONSUMER MATHEMATICS

Introduction to the electronic spreadsheet (VisiCalc)

LESSON: 1L

AIM: What is an electronic spreadsheet?
Who uses these spreadsheets and how are they used?

PERFORMANCE OBJECTIVES: The student will be able to...

1. Recognize the spreadsheet.
2. Become familiar with its uses.
3. Use the computer to access VisiCalc:
4. Develop skill in:
   a) Moving the cursor.
   b) Entering data.
   c) Differentiating between a label and a value.
   d) Recognizing various parts of the spreadsheet.
5. Access the VisiCalc Commands.
6. Correct mistakes in typing.
7. Save the worksheet.

VOCABULARY: electronic spreadsheet, character, data, file, cursor, coordinate, cell, mode

MOTIVATION:

Are there faster ways of manipulating numbers then using the calculator?

- A calculator will find the square root of a number very quickly but it will take twenty-five times as long to find the square root of twenty five numbers.
- If we wish to find the area of one rectangle we can find the answer quickly using a calculator, but if a problem arises where we need to find the area of 100 rectangles then we may choose to use a computer.
- Writing a program to solve these problems requires the knowledge of a computer language.
- Programmers have greatly simplified our lives by writing programs for us that are simple to learn and easy to use.

These programs are called electronic spreadsheets and are marketed under several names.

- In this course we are going to be learning VisiCalc.

DEVELOPMENT:

1. Teacher distributes handout of spreadsheet. A replica can be drawn on the board or the computer can be used as a demonstrator. Pertinent parts of the worksheet are pointed out, explained and discussed.
    a) The meaning of column (named by letters), row (named by number), and cell (named by a letter first and then a number).
    b) The size of the spreadsheet. A...BK, have students calculate, A...Z + AA...AZ + BA...BK = 52 + 11 = 63. Hence the spreadsheet has 63 columns. If we combine this with the 254 rows we get 63 x 254 = 16,002 cells.
    c) Explain that information placed on this sheet is called data. When the sheet is completed and ready to be saved we call this collection of data a file. If a teacher wanted to use this sheet as a marking book she could enter the names of 254 students (not exactly a recommended class size). If two columns were used for the first and last name then there would be enough room left for 61 grades for each student. Lead students to understand that only small portions of the worksheet are used when creating a file.
2. A list of uses for the spreadsheet should be elicited and developed.

PERSON USING THE SPREADSHEET	WHAT THE SPREADSHEET IS USED FOR
Teachers	Save student grades and calculate student averages.
Students	Save all grades in all subjects and calculate averages.
Cooks	Adjust recipe ingredients.
Employers	Calculate employee salary.

Employees	Calculate income taxes.
Merchants	Determine selling price based on cost, percent of profit and sales tax.
Salesmen	Calculate commission.
Clubs	Keep track of membership dues and expenses.
Sports	Calculate batting averages.
Real estate	Project future housing and mortgage costs.

3. The students should now be ready to enter the VisiCalc spreadsheet. Have them put the VisiCalc program disk in the drive and turn the computer on. In a few seconds the spreadsheet will be displayed with the cursor located in cell A1.
   a) For SINGLE DISK DRIVE computers. Remove the VisiCalc program disk and insert the VisiCalc DATA DISK.
   b) For TWO DISK DRIVE computers. Place a DATA DISK in drive 2.
4. Point to the large white cursor in cell A1 and teach students how to move this cursor. Find the arrow keys that are located on the numeric key pad. They are found on the numbers 2,4,6, and 8. These four arrow keys are used for down, left, right, and up respectively. Scrolling to the ends of the sheet is good way to impress students with the size of the spreadsheet. Find the word HOME on the 7 key. By pressing HOME the cursor will automatically return to A1. Depressing an arrow key and holding it down will result in the rapid repetition of that key.
5. Now we may begin entering data. Have students enter their subjects and several grades for each subject. The first time this is attempted by the student it is suggested that the class all enter the same data. (See applications for suggested worksheet.) After this lesson lab sessions can be provided where the student is given time to experiment with his own data. There are two ways

of signalling the VisiCalc program that you have completed entering all the data that you wish in a particular cell.

- Pressing the ↵ key is all that is needed. In the future this key will be referred to as the RETURN key. The cursor remains over the data just entered and to advance to the next cell you simply press one of the arrows, depending on the directions that you intend to move the cursor.
- You can save a little time by doing two things at once. You can enter the data and advance the cursor all at the same time by not pressing the return key but simply pressing the arrow that indicated the required direction of movement.
- For example: GRADE,RETURN,↑ accomplishes the same as GRADE,↑.
  - a) Differentiating between a value and a label. If an entry begins with a letter it is classified as a label. If an entry begins with a number, a + or - key, a decimal point, or a parenthesis it is classified as a value. VisiCalc makes this distinction because numeric operations can only be performed on values. There are some keys that will cause VisiCalc to "beep". This rather unpleasant sound is a signal to you from the program that the key you have just pressed has no meaning at this point. Just as a test try pressing the question mark or the dollar sign. That sound tells you that the spreadsheet program is looking for either a value or a label and the key you just pressed cannot be the beginning character of either.

5. To see how VisiCalc learns and remembers direct student attention to the three top lines.
   - a) The top line is called the cell indicator line. You will see that you can read the coordinates of the cursor's present location on that line. If the cursor is covering a blank cell say B6 then "B6" will appear on the cell indicator line. If there is data in B6 such as GRADE, then B6 (label) GRADE will

appear on this line. What will appear on the cell indicator line if the cursor is over H68 which contains the data 100?

b) The bottom line is called the EDIT/ENTRY line. As we type in our data it appears on this line. When we edit our data it appears on this line as well.

c) The middle line is the COMMAND LINE. We will use it to access the different VisiCalc commands. It's use will become clearer as we develop skill in the use of this program.

7. The use of special keys is vital to the ease of using this program.

a) If an error occurs while entering data we cannot backup with the left arrow. Remember the arrow is used to move the cursor. As soon as the arrow is pressed the VisiCalc PROGRAM enters the data and advances one cell in the direction of the arrow. To correct these errors we use the ESCAPE key. By pressing the ESCAPE key we erase the character directly to the left of the cursor. Have student practice this technique. The delete key on the bottom of the numeric keypad serves the same function.

b) A second way of making corrections as we type is to use the BACKSPACE key which is located directly to the left of the NUM LOCK key. In the future we will refer to this key as the "BKSP" key. It works in a similar fashion to the escape and the delete keys, it backs up one space and erases the last character.

c) Pressing the CTRL key in connection with other keys permits us to accomplish various tasks. When a direction such as CTRL-E is indicated you must depress both the CTRL key and the E key simultaneously. We will learn more about this later.

d) If we find that we are in an incorrect command or have accidently accessed the VisiCalc commands we can return to our original position by pressing the ESCAPE or the BKSP key.

e) Pressing BREAK, which is located on the SCR LOCK key is used to cancel an entire entry or a command. We will learn more about this key in future lessons. It is used to stop the printer or to stop the disk drive when you wish to cancel the printing or saving of a worksheet.

8. The VisiCalc COMMANDS are accessed by depressing the "/" key. Have students press the "/" and read the letters that appear on the top of the spreadsheet on the command line. Do not attempt to teach these commands at this time. Simply describe to students what each letter stands for. Explain that when in COMMAND MODE the program will accept only specific keys depending on the particular mode we are in.

- Students will see the following display on the Command line.

  /BCDEFGIMPRSTVW-

- Tell students:

  /B is the BLANK command.
  /C is the CLEAR command.
  /D is used to DELETE rows and columns.
  /E is the EDIT command.
  /F the FORMAT command.
  /G the GLOBAL command.
  /I is used to INSERT rows or columns.
  /M is used to MOVE data.
  /P is used to PRINT a copy of the worksheet.
  /R is called the REPLICATE command.
  /S is the STORAGE command.
  /T freezes the TITLES in their position.
  /V tells you what version of VisiCalc that you are using.
  /W divides the worksheet into two sections, or WINDOWS.
  /- is the REPEATING LABEL command.

9. It is necessary to know how to correct mistakes after the data has been entered.

   a) The EDIT COMMAND is accessed by pressing "/E". All editing is accomplished on the EDIT/ENTRY line, the bottom of the three top lines. We position the cursor over the entry we wish to edit. As soon as we type "/E" the entry appears on the EDIT/ENTRY line.

Position the edit cursor directly to the right of the character to be edited. By depressing the BKSP key entries are erased in the same manner as was used on the spreadsheet. Now we can also insert a character. Position the edit cursor over the character immediately to the right of the one you wish to insert. For example: let us say you typed "jup" instead of "jump". Place the edit cursor over the "p", type "m" and you will have jump. Students should be given time to practice this technique.

b) Editing mode can also be accessed by pressing CTRL-E while you are still typing an entry. This will cause the word EDIT to appear on the command line and the entry you are typing will appear on the EDIT/ENTRY line. For example if you type "New Jo" intending to type "New York", in location S5, this can be corrected by typing the CTRL-E as soon as you realize that you made a mistake. The display that you will see at the top of the sheet will look like this:

```
S5
(EDIT): Label
New Jo
```

With the cursor after the "o". To correct this the arrows may now be used. Press the left arrow once, erase the "J" with the BKSP key, enter the "Y", press the right arrow to pass over the "o", complete with "rk", and enter on the worksheet by pressing the RETURN key. Since the arrows are used in the editing they cannot be used to enter the data.

10. After the suggested file has been entered the student should be given an opportunity to save his work so that it can be recalled at subsequent lessons. We save a worksheet by typing "/S" and accessing the STORAGE command. This command has several options. Read the letters that appear on the command line. We are interested in the "S" option. This "S" indicates SAVE. Thus by pressing "/SS" we access the command that will save the worksheet. VisiCalc is now prompting us to give the file a name.

11. Choosing a file name is an important part of learning how to use a spreadsheet. We want to choose filenames that are in keeping with the type of file that we are saving. The reason for this is obvious. If we forget in a month or two, what we did today, the filename will tend to remind us. If I were saving a recipe for chocolate cake I wouldn't call it apple pie! Every file name must be unique. That is two different files cannot be saved with the same name. Each file name can contain a maximum of 8 characters. Each character must be a letter, a number, or a period. The first character must be a letter. Give the file a legal file name. The position of the DATA DISK is important at this time. (Teacher should make sure that this was executed correctly at the beginning of the session. This should be done without raising to much student curiosity. Ample time will be devoted to this procedure at a subsequent lesson.)
    - Single Drive requires only the filename.
    - Double Drive requires that you indicate the drive number. For example MYGRADES,D2.

APPLICATIONS:

1. Suggested Worksheet:

MYGRADES

SUBJECT	TEST 1	TEST 2	Test 3	Test 4	Test 5	Test 6
ENGLISH	90	85	87	90	90	95
HISTORY	90	85	91	95	90	95
HYGIENE	95	89	90	92	100	10
MATH	65	65	65	72	80	95
MUSIC	80	80	75	85	80	85
SCIENCE	67	65	70	72	78	88
SPANISH	72	75	70	80	80	90
TYPING	99	100	100	100	100	100

2. The EDIT COMMAND should be accessed and students should practice correcting data on the EDIT/ENTRY line.

3. Practice using the BKSP key to correct errors while entering data.

4. Move the cursor freely around the sheet and see if the student can predict what will appear on the top three lines. For example: "If I position the cursor on T7, what will appear on the cell indicator line?"

5. Students should be asked to explain the effect of pressing the following keys:
   a) HOME
   b) BREAK
   c) CTRL-E
   d) /
   e) BKSP

6. Challenge the class to select filenames for given situations. Reiterate the standards that must be adhered to when selecting a file name.

SUGGESTIONS FOR LAB SESSIONS:

- Make work sheets to display:
  a) Names and Phone Numbers.
  b) Inventory: Item name, number, cost, quantity on hand.
  c) Table of students' (or ideal) heights and/or weights.
  d) Distance in miles between major cities.
  e) Household Budget to include the months of the year and income as well as expenses.

SUMMARY:

1. What is the size of the VisiCalc Spreadsheet?

2. Could an electronic spreadsheet be used to keep track of operating room schedules? Explain?

3. Explain what happens when the "/" key is depressed.

4. How would you access the EDIT COMMAND?

5. Can a filename begin with a number?

6. Can a label begin with a number? (Yes if preceded by a ". This will be covered in the next lesson.)

7. What information is found on the top line of the three top lines?

8. Name the cell that is located by the fifth row and the B column?

9. When naming the coordinates of a cell do we name the row or the column first? Does it matter?

10. How many characters are in the filename MYGRADES?

HOMEWORK:

1. Select the legal file names, give reasons if not acceptable.
   a) Grades
   b) My Friends
   c) Names(1)
   d) Six%
   e) 365 Days

2. From the following list choose the values, the labels or indicate "neither".
   a) Sam
   b) +13
   c) (90)
   d) **A**
   e) 39.98

3. Describe what happens to the data that is located directly to the left of the cursor when the BKSP key is pressed.

4. Explain how the cursor on the body of the spreadsheet differs from the cursor on the top three lines?

5. What key is used to access the VisiCalc commands?

HOMEWORK SOLUTIONS:

1. a) Legal.
   b) Too long, no space.
   c) and d) contain illegal characters. () and %
   e) Begins with a number, must be a letter.

2. a) Label.
   b), c), and e), are values.
   d) Neither.

3. It is erased.

4. The main cursor is a large inverse bar that covers the width of one column and passes over the data in the spreadsheet. It is controlled by the arrow keys. The cursor on the top lines is a solid square.

5. The "/" key.

```
SAMPLE    VISICALC SPREADSHEET
CELL LOCATION OF THE CURSOR DATA OR FORMULA
---------------------------------------------------------------------------------
COMMAND LINE/VALUE/LABEL
---------------------------------------------------------------------------------
EDIT/ENTRY LINE
---------------------------------------------------------------------------------
    A     B     C     D     E     F     G     H     I     J     K     L     ...BK
 1
 2
 3
 4
 5
 6
 7
 8
 9
 10
 11
 12
 13
 14
 15
 16
 17
 18
 19
 20
 21
 22
 23
 24
 25
 26
 27
  .
  .
  .
 254
```

CONSUMER MATHEMATICS

Introduction to the electronic spreadsheet (VisiCalc)

LESSON: 2L

AIM: How is the electronic spreadsheet used to retrieve and manipulate our data?

- What are some of VisiCalc's built in functions and how can we access them?

PERFORMANCE OBJECTIVES: The student will be able to...

1. Use the LOAD option of the STORAGE COMMAND to retrieve previously saved data.
2. Jump the cursor to a given position on the worksheet.
3. Use the cursor as a pointer.
4. Become familiar with the use of the built in VisiCalc function:
   a) Sum
   b) Minimum
   c) Maximum
   d) Average
   e) Count
5. Remove data from the spreadsheet by using the:
   a) BLANK COMMAND.
   b) DELETE COMMAND.
   c) CLEAR COMMAND.

6 Use the INSERT COMMAND to insert a new:
   a) Column
   b) Row

VOCABULARY: pointer, built in function, delete, alphanumeric

MOTIVATION:

Where is the worksheet that we saved yesterday?

- How can we access it today?
- Is there a fast way of sending the cursor to a given coordinate?
- What are some of the ways that VisiCalc manipulates data?

DEVELOPMENT:

1. This lesson should begin by loading the MYGRADES file. The VisiCalc program must be loaded into the computer. A data disk must be available on which the MYGRADES file was previously saved. The placement of this disk depends on whether you are using a one or two drive computer.
   a) One drive computer. Remove the VisiCalc program disk and insert the DATA DISK into the drive.
   b) Two drive computer. Place the DATA DISK in drive 2.
   c) First access the STORAGE COMMAND with "/S". This command has 5 options. We used the SAVE option at our last meeting to save the file we called MYGRADES. Today we are going to use the LOAD option to retrieve that file and do some very interesting things with the data in it. Look at the display at the top of your screen. (L S D Q #) Each letter represents a different option. Today we are going to use the "L" option to LOAD our file. The "D" is used to delete unwanted files from the disk, the "Q" is used to QUIT or exit the VisiCalc program, and the number sign has special uses for advanced users although we will use it to specify a disk drive when we use the "Q" option. We are now ready to LOAD our file so press "L". VisiCalc prompts the user to enter the filename that is to be loaded. If you have only one disk drive simply type MYGRADES after you have changed to your data disk. For two drives you must add a suffix indicating what drive you are using. For example (MYGRADES,D2) to indicate that the data disk is in drive two.
   d) A nice feature of VisiCalc is that you can examine the catalog of the data disk while the spreadsheet is still in front of you. This is useful in the event that you forgot what you named the file, or the way you spelled the filename. To access this catalog you first access the LOAD option of the STORAGE COMMAND with "/SL". When you are asked for the filename type ",D2" to specify the drive location of the data disk. Press Return and see the drive activate. By using

the right arrow key, the catalog is displayed, file by file, on the EDIT/ENTRY line. The command line displays the words: (STORAGE: FILE TO LOAD).. When the MYGRADES file is displayed, pressing return will load it onto the screen. Hence there are two convenient ways of loading a file from a disk. Either type in the filename or activate VisiCalc's data disk file catalog by using the right arrow key and the Return.

e) Explain to students that their MYGRADES file will remain on the disk, exactly as it was saved, unless they choose to alter it. Tell students that the process or retrieving these files is called "loading a file". Stress that loading the file from the disk does not removed it from the disk. Alterations can be made, but only under their control.

2. When the file is initally loaded the position of the cursor is exactly where it was when the file was saved. Tell students there is an eaasy way of jumping the cursor to a given coordinate. This is done with VisiCalc's GO TO option. This is accessed with the greater than sign. When the ">" key is pressed the command line reads (GO TO: COORDINATE) and we see the cursor flashing on the EDIT/ENTRY line, waiting for your direction. Press BK254, the cursor jumps to that position. Name two fast ways to return to A1! Use the HOME key OR ">A1". Practice sending the cursor to various positions on the spreadsheet.

3. One very special feature of VisiCalc is the built in functions. The people that wrote the VisiCalc program taught it how to find the SUM of a group numbers. How to find the AVERAGE, the MINIMUM number, the MAXIMUM number and how to COUNT non zero numbers. The way we access these built in functions is with the "@" key. As soon as the program sees that key, it knows we are going to request a built in function. First we must find the sum of the ENGLISH grades. To send our cursor to H3 we use the GO TO command. Now that our cursor is over H3 we

type "@SUM(B3.G3)". This will give us the sum of the grades in row 3 beginning in column B and ending in column G. Our answer will be placed in column H. To find the AVERAGE of the HISTORY grades, place the cursor over H4 and type " AVERAGE(B4.G4)" and the answer will appear in H4. To find the MAXIMUM HYGIENE grade, position the cursor at H5 and type " MAX(B5.G5)" and 100 will appear in cell H5. To find the MINIMUM MATH grade, position the cursor over H6 and type " MIN(B6.G6) and 65 will appear in H6. To count the number of SCIENCE grades, position the cursor over H7 and type " COUNT(B7.G7) and 6 will appear in H7.

4. Suggest to students that they find the average or the maximum grade for all subjects. Lead them to see that the H column, that they just created, cannot be labeled as there are so many different functions represented. Show them the way to delete the data from that column by introducing the DELETE COMMAND. The DELETE COMMAND erases data from the worksheet. This data is erased in columns or in rows. This command does not permit you to erase selected entries. Only complete rows or complete columns can be deleted. We access this command with "/D". The command line reads (DELETE: R C). The two options of this command are "R" for row and "C" for column. Only one row or one column can be deleted at a time. VisiCalc looks for the cursor and deletes whatever row or column the cursor is positioned at. There are no restrictions on the placement of the cursor within the row or column. Position the cursor with ">J12". If you type "/DR" the twelfth row will be deleted. If you type "/DC" the contents of the J column will be erased. Notice how VisiCalc moves the data. Shifting columns to the left, where necessary, and avoiding empty areas on the spreadsheet. Have students delete only the H column. In the event that errors were made and some students deleted too much they can retrieve their original file from the disk as they did at the beginning of the period. If time permits rows can be deleted as a general practice and then the original worksheet can be loaded again.

5. The INSERT command is very similar to the DELETE command. This command inserts rows or columns at the current position of the cursor. It is accessed by typing "/I". (INSERT: R C) is the display that appears on the command line. As with the delete command the R and C indicate ROW or COLUMN. Position the cursor at coordinate B15. Type "/IC". We see the B column become empty and all data that was in the B column and to the right of the B column has been moved one column to the right. If we enter "/IR" the fifteenth row empties and all data below is moved down one row. Inserting rows and columns is a very handy feature. It permits us to add data wherever we want on the worksheet.

6. Erasing specific entries is accomplished with the BLANK COMMAND. This command will erase the entry at the current position of the cursor. It is accessed by typing "/B". The command line displays the word (BLANK). After Return is pressed the contents of the coordinates where the cursor is located is erased. Have students jump the cursor to various positions on the worksheet, enter some data, jump it away, enter more data, jump it back and blank out the data previously entered. Continue in this manner until students develop skill with this command.

7. When you choose to erase the complete file from the screen you can do this with the CLEAR COMMAND. This command is accessed with "/C". The display on the command line becomes (CLEAR: TYPE Y TO CONFIRM) as soon as you type "Y" the sheet is cleared. Once the display is cleared it can only be retrieved if you remembered to SAVE all of your files before you clear the screen. These files can always be removed from the disk at a later time. The worksheet should be cleared before a file is loaded. If it is not cleared data from an earlier file will become part of the new file. When loading a file cells that are occupied in the new file will write over the cells of the old file, but if the new file begins in row 30 all the data in the old file above row 30 will remain on the screen. Students should be

permitted to create, save, clear and load files. The more practice they have with this technique, the more confidence they will gain.

8. The VisiCalc cursor can be used as a pointer. This may not sound very appealling at first but most experienced spreadsheet users depend on this technique. Try this.
   Position cursor at A1.
   Enter 5.
   ↓
   +
   ↑
   +7
   RETURN.
   You will see a 12 in cell A2. If you look at the cell indicator line it displays:
   A2: (VALUE) +A1+7
   This means that cell A2 is pointing to cell A1 and it will automatically add 7 to any value that is put in A1. Since there is a 5 in A1 the value in A2 is 12. If you change the value in A1 the value in A2 will change as well. Change the number in A1 and watch the number in A2 change accordingly.

- Pointers can also be used to specify the endpoints of a range of data. Let's find the sum of the grades in row 7. Position the cursor at H7, where you would like the SUM to appear. Type " SUM(", move the cursor with the left arrow until it is positioned over B7. Next type a period ".", you will see "@SUM(B2..." displayed on the EDIT/ENTRY line and the cursor will have returned to H7. Move the cursor with the left arrow to G7 and close parenthesis. Your cursor returns to H7. Press RETURN and your sum should now appear in H7. This technique is very useful when you data has scrolled out of view and you cannot remember the coordinates of the endpoints.

9. Sometimes an entry such as 11B is required. Product numbers very often contain both letters and numbers. We cannot call this a value because of the letter. Combinations of letters and numbers are usually referred

to as alphanumeric displays. These entries are really labels and we do not want them thought of as values. To indicate to VisiCalc that we are entering a label when the entry begins with a digit (0...9), a parenthesis, a "+", "-" OR ".", we begin our entry with the " key. This key is not recorded as part of our entry. It is simply a signal to VisiCalc that the entry that follows is a label and not a value.

10. Saving a previously saved file can be a little tricky. VisiCalc knows that you are trying to SAVE a file that you have saved before because the catalog is read when an attempt to save is executed. If two files are saved with the same name the current file overwrites the one previously saved and the old file is lost forever. After executing a "/SS" VisiCalc asks for the filename. If you try to use the same name you will see the prompt (STORAGE: File Exists: Y to Replace). At this point you might just want to type "Y" and replace the old file with the new one, or type any key and begin again. One way around this is to change the name. Call it MYGRADE1. Remember VisiCalc always asks for a filename before saving a file. The problem that renaming the same file creates is that a lot of Disk space is wasted. For beginners, wasting disk space is not a major concern. These files can be deleted at a later time when the students are more comfortable with the program.

APPLICATIONS:

1. Create a worksheet listing at least ten student names:
   a) Save it to the disk.
   b) Clear the screen.
   c) Load it back again.
2. Jump cursor to several locations across the worksheet. Blank out these entries.
3. Enter 5 sets of grades and perform calculations using the built in functions.

4. Reload the MYGRADES file and:
    a) Delete a given test column.
    b) Replace with the insert command and enter new data.
    c) Delete a given subject row.
    d) Replace with the insert a row command, a new subject and grades.
5. Use pointers with simple operations such as (+D3*7).
6. Find the average grade for each subject in the MYGRADES file. Determine the subject with the highest average using the Maximum function on a column.

SUGGESTIONS FOR LAB SESSIONS:

- Load any of the work sheets created in previous sessions:
    1) Jump the cursor to various positions.
    2) Use the BLANK command to erase single entries.
    3) Use the DELETE and INSERT command.
    4) Discuss how rows and columns can be deleted or inserted with the cursor in any position within the column or row.
    5) Calculate sums, averages, find minimum and maximum numbers, on both rows and columns.

SUMMARY:

1. Describe how you would load the file named MILEAGE.
2. What command advances the cursor from A10 to AA10?
3. When the cursor is over cell D15 containing the entry 67, what is displayed on the spreadsheet's cell indicator line? ...X1 containing the entry CHICAGO?
4. When do we use the "@" key?
5. Consider the sets of data: 80,80,90,(blank),83,85 in six columns, and the same set in five columns (with no blank). Compare the result of using the average function on both sets (the same). Compare the results of using the minimum functions on both sets (first set 0, second set 80).

6. What is the fastest way to erase all data from the spreadsheet?

7. If you are finding the average of a very long column of numbers and the end of your data has scrolled out of view should you:
   a) Press ESCAPE and begin again.
   b) Use the arrow keys to position the cursor at the endpoint and then press RETURN.

8. May Kim is in official class 5C. How should this official class designation be entered on the spreadsheet?

9. What do I mean when I say that 5C is an alphanumeric entry?

10. Explain why I can enter "AB45" without a "beep" but when I try to enter "45AB" I am unable to. How can I avoid this problem?

HOMEWORK:

1. How can I load a file that I saved last week if I forgot the name of the file?

2. List 2 ways of advancing the cursor from A1 to BK254.

3. If the cursor is positioned at M34, what is the result of "/DR"? What is the result of "/IC"?

4. What will VisiCalc answer to:
   DATA 73,68,(blank),79,82,90?
   a) @ MIN
   b @ MAX
   c) @ SUM
   d) @ AVERAGE
   e) @ COUNT

5. What is the fastest way to erase the following:
   a) The data in C20.
   b) The data in row 5.
   c) The data in column A.
   d) The entire worksheet.

HOMEWORK SOLUTIONS:

1. The data disk catalog can be accessed after "/SL" is entered. Indicate the current drive ",D2" and press the right arrow key. Each file name then appears on the command line and when the RETURN key is pressed the file whose filename appears on the top will be loaded onto the spreadsheet.
2. The long way is to advance pages using the arrow keys. The short way is to use the GO TO COMMAND. Type "> BK254".
3. The data in the 34th row is erased and all the data that was below the 34th row is moved up one row. When we insert a column the M column becomes blank and all the data that was in the M column and to the right of the M column is moved one column to the right.
4. a) 0
   b) 90
   c) 392
   d) 78.4
   e) 5
5. a) Position the cursor over coordinate C20 and type "/B" Return. The BLANK command.
   b) DELETE the fifth row by positioning the cursor anywhere in that row and typing "/DR".
   c) DELETE the A column by positioning the cursor anywhere in the A column and typing "/DC".
   d) Use the CLEAR command by typing "/CY".

CONSUMER MATHEMATICS

Introduction to the electronic spreadsheet (VisiCalc)

LESSON: 3L

AIM: What are the ways that VisiCalc formats data?
What techniques are used to change these formats?

PERFORMANCE OBJECTIVES: The student will be able to...

1. Define terms:
   a) Default
   b) Format
   c) Global
   d) Justify
   e) Truncate
2. Recognize and change VisiCalc's default formatting for:
   a) Values
   b) Labels
3. Use the FORMAT COMMAND to:
   a) Round off numbers
   b) Change to dollar-and-cents format.
   c) Replace a given number with asterisks.
4. Use the GLOBAL COMMAND to:
   a) Reformat the entire worksheet as opposed to only one section.
   b) Change the size of the column width.
5. Explore the way VisiCalc recalculates and understand:
   a) Automatic recalculation.
   b) Manual recalculation.
6. Appreciate protection schemes that are built into the spreadsheet to preserve a user's data, and the commands that will eliminate this protection.
7. Understand situations that cause VisiCalc to display "ERROR".

VOCABULARY: default, justify, global, truncate, automatic recalculation, manual recalculation

MOTIVATION:

What is the meaning of the word "default"? (According to Websters' New World Computer Dictionary: A value, parameter, attribute, or option that is assigned by the program or system when another has not been specified by the user.)

- What are some of these options that VisiCalc assigns to the data and how can they be changed?
- When changes are made, will it effect all data or can we limit these changes to specific sections of the worksheet?
- Does VisiCalc protect data from being changed by the user?
- What do we mean when we use the words justification and formatting?
- Once a formula has been calculated what happens if we change a number?

DEVELOPMENT:

1. Have students enter the following data into Row 1: 9, 3, 453, NAME, TEST.

```
---A------B------C------D------E---
1      9      3    453NAME  TEST
```

Elicit that when entering values the numbers are placed to the right side but the labels are placed to the left side. Enter the following display on the chalkboard.

```
Test 1      Test 2
90             100
100             99
87              75
etc..
```

Elicit that it is confusing to left align values. Have students enter the word computers. Ask them how this entry is aligned. Lead students to understand that the alignment of an entry only has meaning when the position it is being placed in is bigger than the entry. (When the data is shorter in length than the available field.) Teach them the word "justify". Lead them to verbalize the following. The default justification for labels is left. The default justification for values is right.

2. Have students enter the following display:

Test 1	Test 2	Test 3	Test 4
88	87	79	92
100	98	85	92
81	89	100	78

Elicit that the labels are left justified and the numbers are right justified. Discuss the appearance of this sheet and conclude that this would be less confusing if the test numbers were aligned with the test grades. Explain to students that although VisiCalc's default justification for labels is left, this can be changed by using the FORMAT COMMAND.

a) To right justify the test numbers we must first position our cursor over coordinate A1. Access the FORMAT COMMAND with "/F". The options available under this command are :
(D G I L R $ *)
Each one of these symbols represents a new command. Explain to students that the "L" stands for Left Justify and the "R" stands for Right Justify. Select the R and watch the label move so that its last character rests in the extreme Right position. Move the cursor to B1 and repeat the procedure. "/FR" will right justify this label. Continue in this manner until labels in the top row are right justified. Students should now have the following display.

Test 1	Test 2	Test 3	Test 4
88	87	79	92
100	98	85	92
81	89	100	78

b) The "D" represents the word "default". If the cursor is again positioned over A1 and "/FD" is typed, the label is returned to its default justification. The student should be encouraged to change the justification of various cells and then return them to their default position.

c) The "G" option is used to return maximum precision to values. In the event that "/FG" is typed over a label, it will return the label to its default justification (left). Name this worksheet TESTS and save it with the SAVE option of the STORAGE COMMAND. Clear the Worksheet with the ClEAR COMMAND.

d) Enter the following data:

.89
7.1
35.5
430.07

In the first four rows of the "A" column. Place the cursor over the .89 in cell A1 and type "/FI". The student will see this entry change to "1". Explain that the "I" option of the FORMAT COMMAND is used to round off numbers to the nearest integer. With the cursor still over cell A1 read the cell indicator line on the top of the page. Notice the display.

A1 (V) .89

We see that VisiCalc still remembers the way the number was entered. To return the value to its original format type "/FG". The cell returns to .89. If we would have chosen "/FD" the default option would not have returned our entry to its original state. Reiterate the rule. /FD returns labels to their original justification. /FG returns values to their maximum precision. (Versions of VisiCalc vary. On some computers "/FD" will return the entry to its maximum precision.)

3. Have students begin a new worksheet. Pose the following problem. The student organization is planning to record Ticket Sales, for their next Theater Presentation, on VisiCalc. The cost of tickets are $3.50 for members, $4.00 for students who are not members and $4.75 for friends and relatives of students. Advanced sales have begun and records indicate the following sales:

```
Monday   Tuesday
      3.5      3.5
      3.5        4
        4        4
              4.75
```

The value format we are looking for is dollar-and-cents mode. This can be accessed by using the FORMAT COMMAND. Remember how this command works. First we position our cursor and then we type "/F". This time we are planning on reformatting the entire sheet and not just one or two cells. We will use a different command which will save us considerable typing. This command that we will use changes every value on the sheet. The name of this command is the GLOBAL COMMAND. It is accessed with "/G". As soon as these two characters are typed the display on the command line becomes (GLOBAL: C O R F) by choosing the "F" option we are returned to the FORMAT display. Students should recognize this display as the one that they have been using with the FORMAT COMMAND. Tell students that by accessing this command within the GLOBAL COMMAND they will cause the format of the entire worksheet to change. Make sure that the meaning of a Global change is clear to the students. Contrast this with a Local change which causes only one cell to change.

4. The GLOBAL COMMAND should now be used to reformat all values to dollar-and-cents mode. Type "/GF$" the display should now look like this:

```
Monday   Tuesday
     3.50     3.50
     3.50     4.00
     4.00     4.00
              4.75
```

a) Choosing "/GFG" the GENERAL option of the GLOBAL FORMAT COMMAND will return the display to the way it was originally. Students should be permitted to experiment further with this command. Choose "/GFI" this is the round off option of the GLOBAL FORMAT COMMAND. After this command is accessed all values are rounded off to the nearest integer. Have students return again with "/GFG". Next choose "/GFR" this is the Right justification option. Values are automatically right justified therefore only the labels change position. Next choose "/GFL" to left justify the numbers. To remind students that this is not a wise justification for values, enter a 10 in cell A5. This positioning should be rejected as decimal points are not aligned.

b) Clear the sheet and enter the digits 1 through 8 in the first eight rows of the A column. The display should look like the left diagram below. Choose the "ASTERISK" option of the GLOBAL FORMAT COMMAND. The display will change. Each number will be transformed into that many asterisks, as depicted below on the right. We will use this option, in subsequent lessons, to draw graphs.

```
 ----A----        ----A----
1        1       1 *
2        2       2 **
3        3       3 ***
4        4       4 ****
5        5       5 *****
6        6       6 ******
7        7       7 *******
8        8       8 ********
```

c) The VisiCalc worksheet is very precise. When a number is displayed in GENERAL FORMAT it may shift between scientific and conventional notation. Try to enter the number 123456789. Because there is not enough room in the column VisiCalc will switch to Scientific Notation and enter this number as 1.2346E8. The E8 represents ten to the eight power. It is not necessary for students to understand scientific notation. They should be made aware however, of how precise the spreadsheet is.

d) Sometimes a column is too small to adequately display data. In that case all you will see is the greater than sign. ">>>>>" This display indicated the column width is too small to display an answer.

5. Have students created a worksheet that will display the following data:

   3 tickets were sold at $3.50 yielding $10.50.
   3 tickets were sold at $4.00 yielding $12.00.
   1 ticket was sold at $4.75.

   Elicit column headings. TICKETS COST TOTAL students should begin a new worksheet and the result of entering the above data should look like this:

```
TICKETS  COST     TOTAL
       3      3.5     10.5
       3        4       12
       1     4.75     4.75
```

   Have students conclude that the labels should be right justified. Do this with the GLOBAL FORMAT COMMAND. Next have them suggest dollar-and-cents format. Make sure they understand that if this is done with the GLOBAL COMMAND that the data in the tickets column will have to be changed as well. Lead them to see that they must use the FORMAT COMMAND to change the data which includes the ticket cost and total sales for each ticket.

6. Ask students how many characters are in the width of each column. Lead them to say "the default column width is 9". Tell them that the default column width can be changed. The COLUMN option of the GLOBAL COMMAND is accessed with "/GC" since we are using the GLOBAL COMMAND we can expect all the column widths to change. When the WINDOW COMMAND is taught the student will learn a method of accessing two different column widths on the same sheet. For now all columns will have the same width. After accessing "/GC" the display on the command line becomes: (COLUMN WIDTH) and you are required to type a number. If you type "7" and press RETURN the column width will change to "7". The minimum number of characters for the column width is 3. The maximum number is whatever maximum number your video screen permits. Have students start a new worksheet. Name it Thin.

Begin with 10 and enter all the multiplies of 10 through 90. Tell students that the smaller the column width the more columns you will see on one screen. Decide to make the current column width 4. Select the COLUMN WIDTH option of the GLOBAL COMMAND. Type "/GC 4". After you press return all columns are changed to be 4 characters wide.

7. Have students reiterate what they learned about:
VisiCalc's default values.
Labels are left justified.
Values are right justified.
Column width is 9 characters.
Tell students that VisiCalc's default recalculation is automatic. To understand what this means have them create a new worksheet called SUM.

```
 ┌--A--------B--------C----
1│       2        3        5
2│       1        1        2
3│       4        7       11
```

Have students realize that the values in the "C" column are the sum of the values in the "A" and "B" column. It is important that the C column be created using the SUM FUNCTION. This is a good time to review "@SUM(A1.B1)" with the cursor positioned over C1. When all three sums are calculated move the cursor to A1 and change the entry to 6 by typing "6 Return". Direct student attention to the "C" column. Notice that the entry in C1 is now "9". Have students explain that VisiCalc changed the answer when we changed the example. Next, jump the cursor with the GO TO COMMAND to B3. Change the value to an "8". Watch the entry in C3 change to "12". Tell students that this is an example of another DEFAULT value that VisiCalc employs. Once a calculation is set, the spreadsheet knows that the result displayed in a given cell must be the result of performing some operation on other cells. This operation will be carried out again and again. If you keep changing the data, VisiCalc will keep changing the answer. Ask students if they think this default option can be changed. If their answer is yes, they will also be able to tell you that it can be changed with the GLOBAL COMMAND.

a) If recalculation is not carried out automatically it will have to be done manually. Access the GLOBAL COMMAND with "/GR". This is VisiCalc's Recalculation option. The display on the Command line is (RECALC: A M). The letters represent Automatic or Manual. Since default is automatic and we wish to change the standard value, we will select manual. Return to the SUM worksheet and change data. The "C" column remains unchanged. Move the cursor to the "C" column and check the cell indicator to make sure that the SUM is still there.

b) The order option refers to the way VisiCalc calculates. We suggest the presentation of this topic be left to the discretion of the teacher. The default calculation is down columns first and then across rows. It is sometimes necessary to change this to across rows first and then down columns. This is accomplished by selecting the Order option of the GLOBAL COMMAND. In the upper right corner of the spreadsheet there is a "C". This "C" reminds the user that VisiCalc calculates Columns first. We are now going to change the default option. Type "/GO", the display on the command line becomes: (REEVAL: C R). This represents reevaluate the calculations according to Columns or Rows. If you specify rows the default calculation is changed to rows first. The "C" in the upper right corner changes to an "R" and VisiCalc will change its manner of calculating by considering the rows first.

8. VisiCalc uses a variety of protection schemes. These are helpful to the user in that his data is safeguarded.

   a) When an entry is being typed over previously entered data and you become aware of your error before the return key is pressed, you can still recover the original data. Press Escape until all the new data is erased and the former entry appears, unchanged.

b) When attempting to clear a worksheet with the CLEAR COMMAND, VisiCalc prompts (CLEAR: TYPE Y TO CONFIRM). Unless a Y is typed the worksheet will not clear.

c) Two files cannot be saved with the same name. If this is attempted precious data may be overwritten. When an attempt is made to do this VisiCalc prompts (FILE EXISTS TYPE Y TO REPLACE).

9. Sometimes we try to do something that is mathematically impossible. Other times we may accidentally hit the wrong key. In instances such as this we may see the word ERROR appear in a nearby cell. This is VisiCalc's way of telling us that we are asking for something unreasonable. One such unreasonable request is to ask VisiCalc to divide by Zero. Have students explain why division by zero is not allowed. Try the following.
Position the cursor at B50.
5
↓
+
↑
/0 Return.
The word ERROR will appear in B51.

APPLICATIONS:

1. Experiment to see how the spreadsheet accepts different data when various formats are in effect.

2. Change column widths until:
   a) Only >>> appears notifying user that more space is needed to display an answer.
   b) Numbers are truncated by shortening column widths. Prepare a column with nine entries, beginning with 1, then 12, then 123, and ending with 123456789. Examine what happens as columns are shortened. Define truncating for students as the act of loosing digits from the right of the number.
   c) Point to the scientific notation and remind students how precise this work sheet is.

   - d) Type a label larger than the existing column size. Notice that only a portion of the label appears. Expand the column width until the complete label appears on the body of the spreadsheet.

3. Enter a list of names, first and last in two columns. Change the justification. Explain why values and labels have different default justifications. Explain why labels can be changed from default left to right, but when values are left justified alignment problems occur.

4. Compare the "/FD" option with "/FG". Discuss their uses.

5. Round a group of numbers to the nearest integer using "/GFI".

SUGGESTIONS FOR LAB SESSIONS:

- Load previously prepared worksheets:
  - a) Change justifications.
  - b) Change column widths.
  - c) Change to dollar-and-cents format:
    - 1) By entry only.
    - 2) The entire sheet.
- Use the asterisk option and change integers to stars.
- Experiment with global formats. Determine which options take precedence over others.

SUMMARY:

1. What is the default justification for entering numbers? Labels?

2. What is the disadvantage of entering a value, such as $8.00, as a label using the " key? (VisiCalc would treat it as a label and no operations could be performed on it.)

3. How is the number 45.543 represented when we choose "/F$". (45.54)

4. What is the default column width?

5. What would happen if we tried to divide the contents of cell B5 by Zero and put the answer in B6?

6. Can we recover from typing over previously entered data if we find our error before it is entered?
7. How many asterisks would appear if the cell number is 3.7 and we use "/GF*"? (3)
8. Can values be left justified?
9. What does the word truncate mean?
10. What format represents all values with 2 decimal places?

HOMEWORK:

1. Cell R47 contains the entry .789 and the cursor is positioned over this entry. What will appear in both Cell R47 and on VisiCalc's cell indicator line as a result of choosing the following options.

	Command	R47	Cell indicator
a)	/FI		
b)	/F$		
c)	/F*		

2. Answer parts a-c of question 1 if cell R47 contained the entry 7.295.
3. Explain how the /GF$ will effect the following list of data:
   a) 1.053
   b) 3.89
   c) 7
   d) MONEY
   E) ****
4. Describe how you would change the column width to 6 characters.
5. Collect 3 formulas that you remember from previous Mathematics courses. Use these formulas on numbers of your choice and save them in your notebook. We will need these formulas the next time we use the electronic spreadsheet. At that time you will have an opportunity to check your work.

HOMEWORK SOLUTIONS:

1.

Command	R47	Cell indicator
/FI	1	R47 /FI (V) .789
/F$	.79	R47 /F$ (V) .789
/F*	(blank)	R47 /F* (V) .789

2.

Command	R47	Cell indicator
/FI	7	R47 /FI (V) 7.295
/F$	7.30	R47 /F$ (V) 7.295
/F*	*******	R47 /F* (V) 7.295

3. a) 1.05
   b) 3.89
   c) 7.00
   d) no change
   e) no change

4. /GC6

5. We hope that students will remember some formulas from geometry such as perimeter, area or volume.

CONSUMER MATHEMATICS

Introduction to the electronic spreadsheet (VisiCalc)

LESSON: 4L

AIM: How do we use the REPLICATE COMMAND to copy large lists of data?

Why is it no longer necessary to rewrite a formula each time we use it?

PERFORMANCE OBJECTIVES: The student will be able to...

1. Use the REPLICATE COMMAND to create a new row/column:
   a) From a single entry.
   b) From a row/column that already exists.
2. Review previously learned VisiCalc functions.
3. Replicate these functions by:
   a) Entering coordinates.
   b) Using the cursor as a pointer.
4. Differentiate between Source range and Target range.
5. Write a simple formula and replicate it using:
   a) Columns.
   b) Rows.
6. Use the EDIT COMMAND to change these formulas on the EDIT/ENTRY line.
7. Reference other locations with:
   a) No change.
   b) Changes Relative to the locations.

VOCABULARY: replicate, source, target, range, variable, constant

MOTIVATION:

In the past, when it was necessary to calculate our subject average, we calculated each average separately. Either we used our calculators or the spreadsheet. Some of you may remember my saying that the spreadsheet can find everybody's math average in seconds. Even if everyone has taken 10 math tests.

- Teacher will demonstrate finding averages on a previously prepared data disk. Students will have the opportunity to review the method of loading a previously prepared file, jumping the cursor, and using a built in function.
- Tell students that today we will learn how VisiCalc's most spectacular command permits us to copy data and replicate a formula.

DEVELOPMENT:

1. The replicate command and the process of copying data and formulas is the most powerful command that VisiCalc offers. Once students have mastered this command they are ready to fully enjoy the "speed of computing" that the spreadsheet offers. Begin with the technique of replicating one entry to a different location. Have students create an addition table. Enter the word plus in A1 and the digits 1,2, and 3, in B1, C1, and D1, respectively. We wish to replicate the "1" in B1, and place it in A2. Position the cursor over B1 and press "/R", Return. Enter "A2", or position the cursor over A2. After Return is entered the "1" appears in A2. The word source in this context, refers to the region we wish to copy. Draw a parallel between the word "source" and the word "beginning".

   Develop the following vocabulary.

- The process of replicating data is the process of copying that data, one or more times, to a new location.
- The source is the region that answers the question: What will be copied?
- The target is the answer to the question: Where do you want it copied to?
- The range refers to the starting and the ending coordinate of the region in question. The source range may be only one location. In that case VisiCalc displays B1...B1. On the other hand if we copy to a segment of a column the target range might be B1...B10, where B1 is the beginning of the replicated data and B10 is the ending coordinate.

- Accessing the Replicate command with "/R" brings the display (Replicate: Source Range or Enter)
  to the Command line on the top of the worksheet. When the source range is the single entry under the current cursor position we simply press return. If our source range contains other data, pressing return is not sufficient (more on that later). In this example we aim to copy only one entry, we therefore pressed Return.
  This brought forth the display.
  (Replicate: Target Range).
  There are two ways to indicate our Target Range. Either we point, by moving the cursor to the desired location, or we enter the coordinates of the desired location. After choosing either option we press Return and our data is copied to the new location.
- Have students copy "2", into location A3":
  Position cursor over Cl.
  Press "/R, Return".
  Move the cursor to A3, or enter "A3" and press Return again.
  Continue in this manner until the following Addition Table has been completed.

	A	B	C	D
1	Plus	1	2	3
2	1	2	3	4
3	2	3	4	5
4	3	4	5	6

2. Tell students that you gave a test to a class of 34 students. Every student in that class received the same grade on this current test as they had received on the previous test. Ask students how they think the spreadsheet should be used to enter this data. We hope they will tell you to replicate the previous grades. Save the previous worksheet, name it ADDTABLE. Use "/SS" the save option of the Storage command. Clear the worksheet with the Clear command "/CY". Create a new spreadsheet. Enter 34 grades in column C and label it TEST 1. If time permits enter first and last names in

columns A and B. Label D1, TEST 2 and prepare to copy C2 through C35 into D2 through D35.

1. Position cursor over C2.
2. Press "/R".
3. Hold the down arrow depressed until C35 is reached.
4. Press Return (cursor returns to C2 automatically).
5. Move cursor to D2, press Return.
6. Watch the entire column of grades being copied into column D.

Step 2 needs an explanations. In response to "Replicate: Source Range or Enter" we did not press Return. We choose the source range option by pointing with our cursor to the ending coordinate of the data we wished to copy. The source range data must be adjacent data. The beginning coordinate is determined by the cursor position when the Replicate Command is initiated. The ending coordinated of the source range is either pointed to as we did above or typed on the worksheet. When we type our ending coordinate we see VisiCalc enter three periods. This is the notation that the spreadsheet uses. It happens automatically and does not depend on the user.

- Tell students to make believe that this phenomenon happened three more times. What we plan to do is to copy the grades into three columns at once.

1. Follow steps 1-4 above.
2. Move cursor to E2.
3. Press "." (indicating a Target Range is coming).
4. Arrow to G2 with appropriate cursor moves.
5. Press Return.

The spreadsheet enters three sets of grades for us. When we pressed the "." we see VisiCalc entering "...". Remember this is automatic and does not depend on what key we press. If you wish to enter the coordinates instead of pointing with the cursor you may do so at any time.

3. Continue with the same file. On the next test everyone received a grade of 100. Elicit that you enter 100 once and then replicate it thirty-three times. This is TEST 6 and is located in column H.

1. Enter 100 in H2, press Return.
2. "/R", Return.
3. Enter H3...H35, Return.
4. Watch 34 one hundreds appear in row H.

Have students enter all 90's for TEST 7 in row I.

1. Enter 90 in I2, Return.
2. "/R", Return.
3. Move cursor to I3 and enter a "."
4. Cursor jumps back to I2. Position the cursor over the ending coordinate I35, and press Return.

Name the file OURGRADES and Save it with "/SS". Clear the worksheet with the CLEAR COMMAND, "/CY".

4. Up to this point we have been replicating columns. Rows can be copied too. Create the following row.

	A	B	C	D	E
1	3	9	27	81	243

We wish to copy row 1 to row 10.

1. Position cursor over A1.
2. Press "/R" and arrow to end of data, then press Return.
3. Move cursor to A10, press Return.
4. VisiCalc copied the five numbers.

It is important that students understand how VisiCalc remembers that five numbers must be copied. Lead students to verbalize the following rule.

- When the target range and the source range are the same size, pressing return is all we need to complete our copy. When the target range is larger than the source range we must specify the beginning coordinates of the target range, press the period and position the cursor with the arrow keys to the ending coordinates. Have students copy row 1, five times, into rows sixteen through nineteen.

1. Position cursor in A1.
2. "/R E1", Return.
3. A16.A19, Return.
4. Watch all five rows appear on the screen.

This is a good time to see how VisiCalc calculates down columns first. If you have time for experimentation change to Row first calculations and witness the difference in the way the data is entered. This little exercise will benefit student understanding.

5. The process of learning how to write, and replicate a formula is the first step some students will take toward programming a computer. Tell students they are about to teach the spreadsheet to perform a task. Before we can teach VisiCalc anything it is wise to have some available data so that we can see the results of our instruction. Clear the worksheet with "/CY" and enter 3,7,12,25,48,96 in column A. Let students decide that they want to teach the spreadsheet. Keep it very simple. Something like "add 3", "divide by 2", etc. After the class has made its decision everyone should work together. Let us assume the class agreed to teach the spreadsheet to add 5. When writing formulas the rule is to position the cursor where you want your answer to appear. Agree to place the results (of adding 5 to the A column) in the B column. Place the cursor in B1.

- Enter + A1 + 5, Return.
- Eight will appear in B1.

This can also be accomplished by using the cursor as a pointer.

- Position cursor in B1.
- Type +, <, +5, Return.
- Eight will appear in B1.

In both cases read the formula on the cell indicator line, + A1 + 5. Tell students that the A1 in the formula is called a variable. It is used to represent the number that is in cell A1. Right now there is a "3" in cell A1, but if we decided to change it, then A1 will represent whatever number we changed it to. Direct students to write a formula for the next example, using a variable. "+ A2 + 5", and A2 represents the number "7". The next formula is "+ A3 + 5", etc. Tell students that the variable changes relative to the cell location. Explain that we are going to replicate this formula relative to each of the remaining cells.

1. Position the cursor over the cell that contains the formula you wish to replicate. (B1)
2. Press the following sequence of keys: "/R", Return. You are asked for the target range. Either enter the coordinates of the target range, separated by a period or position the cursor at the beginning, press ".", and position the cursor at the end press Return. The display at the top of the page is quite full now. The very top line contains the cell, (V) for value, and the formula. The middle line contains: (Replicate: N = No change, R = Relative change.) The bottom line, the EDIT/ENTRY line also contains the formula, although you do not see all of the formula. The cursor is positioned over the first variable. VisiCalc is asking you if you want to replicate this variable. Relative to the other location or with no change (exactly as it is). Since this is a Relative change we press "R". The cursor now jumps to the next variable in the formula and asks the same question. We are required to tell VisiCalc whether each variable in our formula is to be replicated with N(no change) or with R (relative change). We want the relative change for our variable. We press "R" once.
3. VisiCalc fills B2 to B6 with values 5 more than the corresponding A values. Return the cursor to B1. Depress the down arrow and read the display on the Edit/Entry line for each occupied call in the B column. Students will see how the variable changes relative to the given location. Practice this technique by seleting two more very simple formulas.

6. Tell students we are now going to create a multiplication table. We will save the worksheet and print it at a later date (as soon as we learn how to use the printer). This table will be created from a single "1" that we will enter into cell A1, the replicate command and a few simple formulas that we are going to write. Clear the worksheet and enter the "1" into coordinate A1. Write a formula that will successively add 1 to each number.

This table can be made any size at a latter date. For this lesson I suggest we limit it to ten. The formula will be + A1 + 1.

1. Position the cursor over B1.
2. Press +, ←, +1, Return.
3. Press "/R", Return.
4. C1.J1, Return, or use the cursor as a pointer.
5. Press R for Relative change.
6. The numbers 1...10 should appear in the first row.

Call these the multiplies on ONE and direct students to create the multiplies of TWO.

1. Position cursor over A2.
2. Enter +, ↑, * 2.
3. Copy step 3 above.
4. B2.J2, Return and copy step 5.
5. The multiplies of two should now be displayed on the worksheet.

Have students understand that the formula they created was A1*2 and that this formula is set up to change relative to each location. Point to the "2" in the formula. Ask students if this "2" is a variable. Lead them to see that it is a constant. Discuss the formulas that will be needed to complete this table. A1*3, A1*4, A1*5, ...A1*10. We are going to copy the formula A1*2 into all the cells in column A ending with A10. Clearly we do not want all rows to be multiplies of 2. Remind students of the Edit Command. Lead them to understand that we can edit the formula A1*2, by changing the 2 into a 3, and then a 4, and then a 5, etc. Our plan is to copy this formula and then to edit the constant.

1. Position cursor over A2.
2. Press "/R", Return, A3.A10, Return.
3. "N" for No change.
4. Stress the selection of NO CHANGE. We want our variable A1 to remain the same. Remember it is the constant that we wish to change.

7. Review the EDIT COMMAND. Editing formulas is the same as editing labels and values. Access the command with "/E". The formula can be seen on the Edit/Entry line, the

bottom line of the three top lines. When a label or formula is being edited on the Edit/Entry line pressing Break will erase all characters. To begin editing our formula we must position the cursor over A3. Press "/E" and enter the EDIT COMMAND. Focus your attention to the formula that appears on the EDIT/ENTRY line. Move the right arrow 5 times until the cursor has passed the "2". Type the BKSP key and then the "3" key and then press Return. Change the next formula: ↓ , "/E", → five times until the cursor has passed the "2", type the BKSP key and the "4", Return. continue the above routine until all ten formulas are corrected. You will see the numbers 1 through 10 in the A column.

8. The body of the table is completed by replicating these formulas across the rows.
   1. Position the cursor over A3(correct formula is on cell indicator line).
   2. Press "/R", Return.
   3. B3.J3, Return.
   4. Press "R" for relative change.

   Repeat the above routine. Position the cursor over A4, A5, A6...A10, until the table is complete. Students will benefit from the repetitious nature of this exercise if they are questioned as to the difference between NO CHANGE and RELATIVE CHANGE. Stress that the formulas in column A all depend on A1, but the formulas used to create the rows, depend on cells that change, relative to each column. Name this file XTABLE and save with "/SS".
9. Have students clear the worksheet with the CLEAR COMMAND. If possible students should be encouraged to have their own data disk. This disk can be used in the daily lessons as well as during lab sessions. Personal student files can be created and saved on this disk. Each disk could belong to one student or a group of students and be collected at the end of the session, by the teacher, for safekeeping.

APPLICATIONS:

1. Load the MYGRADES file and replicate TEST 2 in a column headed TEST 7.
2. Find the average of the English grades and then replicate the average for each subject, down the column.
3. Find the average of the grades in TEST 1. Replicate this built in function for each test, across the row.
4. Find the minimum grade for each subject by finding the TYPING MINIMUM and then replicating up the column, using pointers.
5. Enter a new subject, LATIN, in the following manner. Insert a row between Hygiene and Math. Enter the label LATIN in the subject column. Replicate the row of Math grades by copying that row of grades into the one we just created for the LATIN grades.

SUGGESTIONS FOR LAB SESSIONS:

- Students should be encouraged to keep their own personal grade statistics on the worksheet. The files could be named by using their names or a combination of their initials and the word "grade", "marks" or "scores".
- The multiplication table could be extended to "12 x 12" or "25 x 25".
- Have students offer formulas that they collected in a previous homework assignment. These formulas should be entered and replicated for groups of data.
- Calendars can be created with the replicate command by adding one and properly formatting.
- The bisection algorithm always fascinates students. Begin with any number and successively divide by 2.

SUMMARY:

1. What is so special about VisiCalc's ability to copy?
2. What is a source range? A target range?
3. Where must the cursor be when we type "/R"?
4. Can rows be replicated directly into columns? (no)

5. Can we make five copies of one row? (yes)
6. What is the difference between "No change" and "Relative change"?
8. What is a variable?
9. What is a constant?
10. Can formulas be edited? Explain?

HOMEWORK:

1. Write a formula that will:
   a) Multiply the contents of B5 by 12.
   b) Add 6 to the contents of C1.
   c) Divide X3 by 15.
   d) Subtract 32 from D41.
   e) Double J12 and then add 7 to the result.
2. Name the variable(s) in each formula:
   a) @AVERAGE(T14...AA14)
   b) @SUM(H5...L5)/M5
   c) +B2*17
3. a) Which, if any of the formulas in ex. 2 contains a constant?
   b) Which, if any of the formulas in ex. 2 contains a built in function.
   c) Where should the cursor be positioned if we want our answer to appear in cell A50.
   d) What is the result of executing ex. 2c, if cell B2 contains the number 17.
   e) What is the result of executing ex. 2b using the following data. The cursor is positioned on cell N5.

	H	I	J	K	L	M	N
5	70	75	80	85	85	5	

4. I wish to replicate the formula C1*15 that yielded the 30 in D1, so that the remaining numbers in column C will be multiplied by 15 as well.

	A	B	C	D
1			2	30
2			4	
3			6	
4			8	
5			10	

Should I choose the "No change" or "Relative change" option?

5. Assume the procedure in ex. 4 has been completed. What data will appear in column D.

HOMEWORK SOLUTIONS:

1. a) + B5*12
   b) + C1 + 6
   c) + X3/15
   d) + D41 - 32
   e) + 2*J12 + 7

2. a) T14, AA14
   b) H5,L5,M5
   c) B2

3. a) C
   b) A,B
   c) A50
   d) 289
   e) 79

4. Relative change.

5. The numbers in column D would be:
   30
   60
   90
   120
   150

CONSUMER MATHEMATICS

Introduction to the electronic spreadsheet (VisiCalc)

LESSON: 5L

AIM: How can we prevent specific areas of the spreadsheet from scrolling out of view?
Is there a way to rearrange our data by moving columns or rows to new positions?

PERFORMANCE OBJECTIVES: The student will be able to...

1. Use the TITLES COMMAND to freeze:
   a) All rows at and above the cursor.
   b) All columns at and to the left of the cursor.
   c) Both columns and rows.
   d) To return the spreadsheet to its default position.
2. Use the MOVE COMMAND to move data within the spreadsheet:
   a) Columns to new column locations.
   b) Rows to new row locations.
3. Review cursor locations.
   a) Entering coordinates.
   b) Pointing.
   c) Moving right and up as opposed to left and down.
4. Work with the split spreadsheet:
   a) Using the WINDOW COMMAND.
   b) Using options of the WINDOW COMMAND.
   c) Using the SEMICOLON to move the cursor between windows.
   d) Change column widths in each window.
5. Understand how VisiCalc recalculates:
   a) By order.
      1) Calculation by columns.
      2) Calculation by rows.
   b) By frequency.
      1) Automatic calculation.
      2) Manual calculation.
6. Force a recalculation by using the !.

VOCABULARY: synchronize, unsynchronized

MOTIVATION:

- Have students load their original worksheet that they called MYGRADES. Have them display only the average column. Let them change computers and pose questions such as:
  a) What is the highest average?
  b) In what subject was the highest average achieved?
- Elicit the need to freeze specific areas of the worksheet.
  a) A row or column that would not move out of view.
  b) Moving the average row next to the subject row.
  c) Splitting the worksheet in two parts, each one scrolling separately, so that any two rows or any two columns can be placed in an adjacent manner.

DEVELOPMENT:

1. The MYGRADES worksheet should be loaded in the computer and the need to fix the names of the subject in place, so that they cannot scroll off the screen, should be established. Teach students that the TITLES COMMAND can only freeze rows at the top and columns to the screen's left. We cannot decide to freeze interior rows or columns. We can freeze row three, only if we freeze row one and two as well. We can fix column B by fixing column A as well. Positioning the cursor properly is vital to the correct execution of this command. Offer the following diagram to clarify instructions.

```
--------------------------------------

              FIXED ROWS

        X//////////////////////////////
         \
FIXED    \
COLUMNS  \      NON FIXED AREA
         \
         \
```

THE PORTION OF THE DIAGRAM USED AS A DELINEATOR AND REPRESENTED BY THE "/,\, or X" IS PART OF THE FIXED AREA.

a) For fixing rows the cursor should be positioned in the BOTTOM row that we wish to fix. This is indicated by the "/", in the diagram above.

b) For fixing columns the cursor should be positioned in the RIGHTMOST column we wish to fix. This is represented by the "\" in the diagram above.

c) For fixing both column(s) and row(s) the cursor should be positioned in the bottom row and in the rightmost column of the region we wish to fix. The cell marked with the "X", in the diagram above.

d) We access this command with "/T" for TITLES. Our options are (Titles: H V B N) The "H" or the horizontal option will fix horizontal rows at and above the cursor, "V" will fix vertical columns at and to the left of the column that contains the cursor. The "B", the both option fixes both top row(s) and left column(s), while the "N", the none option cancels any "fix" that was previously made.

e) Once Titles are fixed they will never scroll off the screen until they are removed. The cursor will move freely amid the non fixed area. If it becomes necessary to change a Title the titles must first be cleared with "/TN" the desired title edited and the Titles fixed again.

f) To fix the subjects in place position cursor anywhere in column A. Access the TITLES COMMAND with "/T" and choose the "V" option. This is all that is needed to prevent column A from scrolling off the screen. To fix the test numbers position the cursor anywhere in row 1. Access the TITLES COMMAND with "/T" and choose the "H" option. Row one will remain in place at the top of the screen.

- Have students restore the worksheet to its original state with "/TN" and then fix both column A and row 1 with the "both" option by positioning the cursor in cell A1 and pressing "/TB". The cursor should be jumped away from the titles and then an attempt should be made to enter the first row or column. VisiCalc's beep will indicate that this region can not be entered and students will be aware that this command has been correctly executed. (The cursor must be jumped away from the titles area before an attempt to enter is made.)

- Students should be given a few minutes to scroll the screen up and the right to impress on them the way the titles remain in place.
- Freezing more than one column or row at the same time is another useful activity for students at this time.

2. VisiCalc's MOVE COMMAND is used to reposition data on the spreadsheet. It is useful to have when rows or columns are inserted incorrectly and deleting or retyping data is too time consuming. The MOVE COMMAND is especially useful when only a portion of the spreadsheet is to be printed. For example, we wish to print only the subject and the average grade for each subject of the MYGRADES file. Assume the averages are in column I. The subjects are located in Column A. We have two options. We can move the subject next to the average or the average next to the subject. Because of FORWARD REFERENCE, which is discussed later in this lesson, it is best to move the subjects. Remind students how column I was created. Position cursor in cell I2 and read the cell indicatior line. Notice that the formula AVERAGE(B2...H2) was used to create column I. When data is moved, many activities take place on the worksheet. Let students conjecture about the changes that will take place in the formulas as a result of this move.
   a) When we choose to move column A to column H we are moving our data to the right. Column A is temporarily deleted. All columns to the right are moved one column to the left, to fill the space vacated by A. My desired destination for A is to be H. The column that I specify as my destination will not move. I specify column I. Column I does not

move. Every column to the left of I moves one column to the left. Column H is now empty. This is exactly what we wanted for now column A fills the vacated column H.

- Rule: When moving a column to the right. The destination column must be the column to the right of the desired location. If I choose column T as my desired location I must specify column U as my destination column. To move data from column H to column X the specified destination column is column Y.

- To move column A to column H:
  1. Position the cursor anywhere in column A.
  2. Access the MOVE COMMAND with "/M" for MOVE.
  3. The display on the command line reads MOVE: FROM...TO.
  4. The edit entry line displays the cell location of the cursor.

This is the answer to "FROM". If the cursor was originally located in A4 then VisiCalc is getting ready to move the contents of either column A or of Row 4 to a new location that we must now specify. If the row number remains the same then a column will be moved. If a column letter remains the same then a column will be moved. If a column letter remains the same then a row will be moved. We still want to move column A to column H so we type ".14 Return". When we type one period VisiCalc displays three periods. Watch this occur on the command line while waiting the few seconds it takes for the VisiCalc program to complete the move.

b) After this move has been made ask students what they think happened to the formula that was originally in column I. Remember it was the average of the grades in B through H. Now column H contains the subjects and the grades are located in columns A through G. Move the cursor to the average column and read the formula on the cell indicator line. If this move was correctly executed the Average column is still column

I. Positioning the cursor over I2, the cell indicator line reads AVERAGE(A2...G2). Elicit that VisiCalc changed the formula from (B2...H2). Have students verbalize. After a column has been moved, all variables referencing cell locations are automatically changed to correspond to the coordinates of the new locations. Ask students if they think moving rows preserves formulas as well.

c) It is sometimes expedient to move columns to the left. This type of a move is used frequently when numerical calculations are not involved. Let us move column I to column B. We position our cursor anywhere in column I. As soon as we specify "I" as our "from column" it is emptied, but now the computer is signaled that the move is being made to the left. The data is "H" is pushed into "I" and the column that we specify as our destination must also move one column to the right. Thus to move column I to column B we specify "B" as our destination. The data in column B will be pushed into colunm C and every column to the right of and including B will be moved one column to the right. (Draw a parallel between this and the insert command which works in a similar fashion.)

- Rule: When moving data to the left, the destination column is specified as our desired location. Thus a move from "I" to "B" would result in our specifying "B" as our destination.

- To move column I to column B.
  1. Position the cursor anywhere in column I. (I2 for example.)
  2. Press "/M".
  3. Use the left arrow to move cursor to column B, press Return.

     (We could have typed ".B2 Return".) This alternate way to specify the destination coordinates is useful and fast. It is especially handy when our data has scrolled out of view and we cannot remember the coordinates of the destination cell. We are choosing our destination location by pointing with the cursor.

e) Rows can be moved up or down. Moving a row down is similar to moving a column to the right. This time we position our cursor below our desired destination instead of to the right of it. To move row 6 to row 60 we first position our cursor anywhere in row 6 and then point our cursor to row 61. If we had positioned our cursor at H6 we might have selected to type ".H61 Return". When moving a row up we observe the same rules as we used to move a column to the left. Our destination column is now our desired location. To move row 100 to row 89, we position our cursor in row 100 and then point it at row 89. (Or we could position our cursor in cell T100 and type "/M.T89 Return".)

f) Have students move the Math grades to the row below the Typing grades and then move the Typing grades to the row below the English grades. Elicit that formulas are still preserved and reword our former rule to read "After a row or column has been moved...". Remind students that after they learn to print their worksheets (next lesson) they will find many uses for the move command.

3. The fact that formula references are changed as a result of the MOVE COMMAND causes the spreadsheet to continually recalculate after every move. Students experimenting with the spreadsheet may, in a rare instance, find that an incorrect answer is displayed. An understanding of the way the spreadsheet calculates is important if a correct explanation of why this type of error can occur is to be given. The following notes are recommended for teacher use only, or as enrichment for those students who will benefit form this discussion. First, a few informal definitions:

- Circular reference: Assume B10 is an empty cell. Position the cursor over B10 and type +B10+5. First a five flashes in B10 because when a cell is empty VisiCalc assumes it contains a zero. Next a ten appears in B10 as we realize that the spreadsheet is recalculating. Force another recalculation by pressing the exclamation point ("!"). The value will change to a 15 because the cell now contains a 10 and is no longer empty. In fact with every recalculation (pressing of the exclamation point) you force, the entry in B10 will be stepped 5 units.

- Forward reference: When you plan the worksheet attention must be given to the position of a formula that references other location. These formulas must be placed in a location that is calculated after the referenced locations have been calculated. We have already discussed the default calculation by columns and the option, calculating rows first. If the sheet is set up to calculate by columns, (check to see if there is a C in the upper right hand corner) calculation begin in cell A1 work down column A move on to B1, work down column B and continue in this manner, calculating down each column until the last cell has been reached. Our formulas must be placed either below the cells they reference or to the right of the cells they reference. If we have changed to row first calculations, (and an R appears in the upper right hand corner) then VisiCalc begins to calculate in A1 and continues along the first row, calculating B1, C1, etc. until it comes to the end of the row. It then resumes calculations in A2 and completes the second row. Each row is then calculated in order until the very last cell is reached. Formulas must be placed in the row below the referenced location, or in a cell to the right, if using the same row. Consider the following example:

	A	B	C
1		+C1	+A1+3
2		+C1	

If you place a 5 in A1 then C1 will become 8. B1 and B2 will be calculated before C1 becomes 8 and their value will depend on the value that was previously in C1. If we change to "row first calculations", B2 will be correct because it is calculated after C1. B1 is an example of what we mean when we caution users to be alert to forward reference. Thus students experimenting with the MOVE COMMAND may find errors with the spreadsheet's calculations. If these errors cannot be corrected by:

1) Changing the order of calculation (to row first).
2) Forcing a recalculation with the explanation point.

Then look for forward referencing. Explain to students that their answer is being calculated before one of the numbers in the example has been calculated.

4. The WINDOW COMMAND is used when columns or rows are too wide apart to appear on the same screen and the user finds it necessary to look at one, while working with the other. The students many want to reposition the data by using the Move Command. Have students understand that the Move Command is used for a more permanent type of change. The WINDOW COMMAND is used for a temporary change. If they suggest the TITLES COMMAND remind students that only top or extreme left rows can be frozen with the TITLES COMMAND. Windows can be created anywhere on the spreadsheet. Splitting the screen into two windows provides for more flexibility that either the TITLES or the MOVE COMMAND. Distant rows or columns can be compared, inspected, or examined. Formulas positioned far from their data can be viewed as data is changed. To access this command we type "/W" for Window.
The options are:
(Window: H V 1 S U)

1) H: This causes a horizontal line to be drawn on the spreadsheet transforming it into two windows that appear to be located one on top of the other. The horizontal line contains the column letters that benefits clarity.

2) V: This causes a vertical line to be drawn on the spreadsheet transforming it into two windows that are situated side by side. The vertical line contains the row designations and there is no difficulty determining what row you are viewing. The windows need not be symmetrical. The dividing line can be placed anywhere the user desires.

   a) Choosing the vertical option. Let us assume all columns are the default column width of 9. The full screen displays 8 columns A - H. (Some early versions of VisiCalc display only 40 columns, in that case you will see only through column D.) I have entered a customer number in column B and I wish to keep this number visible while I examine the customer account. I decide to split the worksheet with a vertical line and place the window between column B and C. The cursor must be positioned in column C, the left boundary of the righthand window. The result is a two column lefthand window and a six column righthand window.

   b) To split the worksheet with a horizontal line I choose the top row of the bottom window for my cursor position. If my top window is to contain five rows I position the cursor in any cell in the sixth row before I access the window command.

   c) Once the spreadsheet has been divided into two windows we can only work in one window at a time. After the window has been accessed the cursor will be in the top window or the left window. The position of the cursor determines the window that we work in. Let's create a window by placing a horizontal line above the seventh row. Position the cursor in row 7 and press "/WH". A horizontal line appears between rows 6 and 7. The cursor is positioned in the top window. The arrow keys will cause the top window to scroll up and down, right and left. The bottom window remains unchanged. It is possible to see column A on top of column J.

The cursor can be jumped across the window boundary by pressing the semicolon. (JUMP COMMAND for Windows). When this key is pressed the cursor will pass the the bottom window and this bottom window will scroll when the arrows are moved while the top window remains stationary and unchanged.

5. In most cases we will want our windows to scroll together in a synchronzied fashion. If the left window displays rows 19 through 36 and the data in the right window are in rows 1 through 18, we have defeated our original purpose. We wanted to be able to view our customer accounts, but they are no loner adjacent to the customer number. To correct this I must choose the synchronized option of the Window command. It is accessed by pressing "/WS". This can only be executed after we have split the sheet vertically or horizontally. (Remember the first time we entered the window command we did so the "/WV" or "/WH", vertically or horizontally.)

- If you choose the "1" option you are returned to one window and the spreadsheet is no longer divided. This is the option we will use to clear the spreadsheet of its window.

- Choosing synchronized will insure that both windows scroll together. If they are split with a vertical bar the row numbers will be the same in both windows at all times. You will be able to place any two columns in an adjacent fashion on either side of the vertical divider and be confident that the same row is being viewed. If you choose to split the screen horizontally, you are assured the columns will be the same if the synchronized option is selected. Now you can place any two row numbers next to each other, above and below the dividing window.

- Try the following sequence.
    1. Position cursor at C5.
    2. Press /WV.
    3. Press /WS (to choose synchronized).

4. The worksheet is now divided by a vertical bar into a three column left window and a five column right window. The cursor is in the left window. Depress the down arrow and hold it down. Watch the row number scroll together.
5. Press /WU (to unsynchronize the windows again).
6. The cursor is still in the left window. Depress the down arrow and hold it down. Now only the left window will scroll. The right window remains unchanged.

6. An extra special feature of VisiCalc's WINDOW COMMAND is that column widths can differ in each window. Place a window between columns D and E.

Position the cursor in E.
Press /WV.
Press /WS.

We now have two side by side windows with 9 characters columns in each window. The current cursor position is in the left window. Let's access the GLOBAL COMMAND to change the column width. "/GC5 Return" and the left window columns have changed to 5 characters each. Notice the right window columns are unchanged. Jump the cursor into the right window with the semicolon and type "/GC3 Return". Now we have 3 character columns in a right window adjacent to 5 character columns in a left window. If the window is eliminated by pressing "/Wl" then the entire sheet takes on the column width of the window that contained the cursor at the time the full sheet was restored. Column widths can also be different in top and bottom window as well. Split the sheet horizontally and choose a column width of 10 for the top window and one of 5 for the bottom. This can be accomplished with the following sequence of steps.

1. Position cursor in H6.
2. Press /WH.
3. Press /GC 10 Return.
4. JUMP with ;.
5. Press /GC 5 Return.

Students find this division move an obvious one.

APPLICATIONS:

1. Create a worksheet that displays the results of a class charity drive. Include student name and daily amounts collected for a one week period. Freeze the student names and the names of the weekdays.
   - Calculate daily Sums, using the built in function, as well as Sums by student name.
   - Find a grand total for the class.
2. Unfix the Titles.
   - Move the student names next to the total amount they collected.
   - Interchange Tuesday and Thursday and see the formulas reference the new locations.
3. Use the window command to separate the boys and girls. Make sure that all are grouped together according to sex.
4. Use the window command to separate the students according to sex. Find new totals and fix Titles in place again.
5. Change the column widths in the two windows. Make the boys columns 12 characters wide and the girls columns 7 characters wide.

SUGGESTIONS FOR LAB SESSIONS:

- An exercise changing fractions to decimals and percents can by very useful to students. This affords an opportunity to review the Replicate, Insert, and Titles Command, as well as the different label and value formats.
  - a) In the first 10 rows of column A enter the numbers one through ten.
  - b) Position the cursor in column C and divide each of these cells by ten using the replicate command to speed calculations.
  - c) Position the cursor in column D and multiply each cell in column C by 100. Use the replicate command.
  - d) In column B use the " to indicate a label and enter 1/10, 2/10, 3/10...10/10 in each row.
  - e) Insert a row at the top and label column B FRACTION, column C DECIMAL, and column D PERCENT.

   f) Fix the titles.
   g) Format column C to the special value format "$" using "/F$" thus yielding two decimal places.
   h) Right justify the labels with "/FR".

- Repeat the same procedure with thirds, eighths, sixths, any number.
- Save the worksheet so that it may be printed.

SUMMARY:

1. What does the Titles Command do?
2. Can we fix more than one column? More than one row?
3. Is it possible to fix rows 1,2, and 3 as well as column A, all at the same time? (Yes)
4. Can column B be fixed with row 1? (No)
5. Into how many windows can the spreadsheet be split? (Only two.)
6. How can I cause a left and right window to scroll together?
7. What happens when I choose option "1" of the Window Command?
8. How can I move the cursor between windows?
9. If I wish to move column B to column K, what column must I specify as my destination column?
10. To move row 5 to row 50, what row is specified as my destination row?
11. Is my destination always specified by one row after my desired location? (No, when moving up or to the left we specify our desired location.)
12. Can more than one column width be displayed on the same screen? ...under what circumstances is this permitted?

HOMEWORK:

1. Where must I position the cursor:
   a) To fix the titles in the A and B columns?

b) To fix the titles in row 1?

c) To fix the titles in the A column and in the first two rows.

d) To create a side by side window between columns F and G.

e) To create a top and bottom window between rows 16 and 17?

2. a) What column must be indicated as my destination column if I wish to move column A to column K?

b) What row must be specified as my destination row if I wish to move row 16 to row 25?

3. How do I move the cursor between windows?

4. Cell A1 contains the value 14. What values will VisiCalc assign to the following cells as a result of entering the following formulas?

a) Cursor over B1, 5*A1.

b) Cursor over C1, +A1+22.

c) Cursor over D1, +A1-9.

d) Cursor over E1, +C1/9.

e) Cursor over F1, +E1*D1.

5. Consider the following spreadsheet display:

	A	B	C	D	E	F	G
1	75	68	84	78	82	81	78
2	71		75	72	72	77	
3	82	80			95	94	
4	80	79	78		80	81	
5	100					68	

G1 (value)@AVERAGE(A1...F1)

The cell indicator line displays the formula in G1. I wish to replicate this formula with relative change in (G2...G5). Find the values in G2,G3,G4,G5 as a result of this replication.

HOMEWORK SOLUTIONS:

1. a) Anywhere in column B.

b) Anywhere in row 1.

c) A2.

d) In column G (upper left corner of right window).

e) In row 17 (top row of bottom window).

2. a) Column L.

   b) Row 26.

3. With the semicolon ";" which accesses the Window Jump Command.

4.

	A	B	C	D	E	F
1	14	70	36	5	4	20

5.

	G
1	78
2	73.4
3	87.75
4	79.6
5	84

CONSUMER MATHEMATICS

Introduction to the electronic spreadsheet (VisiCalc)

LESSON: 6L

AIM: How can we use the printer to prepare a hard copy of our spreadsheet?

- How do we prepare a diskette to receive and save our data?

PERFORMANCE OBJECTIVES: The student will be able to...

1. Use the PRINT COMMAND to make a hard copy of the spreadsheet.
2. Prepare a neat and orderly format for the printed form by using:
   a) The repeating label command.
   b) Proper spacing, "-" and "&"
   c) Special type face.
      1) Condensed (^E^H51)
      2) Enlarged (^HOE)
3. Select an appropriate title and print it on the worksheet using the:
   a) " Setup option.
   b) R, Return character.
   c) L, Line feed.
4. Explain the reason for initializing new diskettes.
5. Use the Storage Command options to:
   a) Initialize a new diskette.
   b) Delete files from the disk.
   c) Quit the VisiCalc program.

VOCABULARY: hardware, software, hard copy, initialize a disk, format a disk, customize, hexadecimal, compatible, report

MOTIVATION:

- How are diskettes prepared for receiving and saving our data?

- Is a diskette the only way to save our worksheet?
- What is the meaning of the phrase hard copy?
- How do we print the worksheet?
- Must we print the entire spreadsheet or can selected areas of the worksheet be printed?
- How do we use the printer and what are some of the printer options available to us?

DEVELOPMENT:

1. Show students a new box of disks and tell the class that the disks were just purchased. Ask the question: "Can we take one of the disks o t of the box, put it in the computer and use it as a data disk to save our files". Elicit the need to initialize the diskette. Tell students that this process prepares disks in the following ways.
   a) It puts the Disk Operating System (DOS) on the disk. For some VisiCal^ disks the operating system is called IBM DOS 2.1. Tell students that as a result of this type of preparation the formatted disk can only be used with operating systems that are compatible with this DOS. It cannot be used in an APPLE computer or an ATARI, a RADIO SHACK or with CPM programs. It is like trying to put a three pronged plug into a two pronged socket.
   b) A guide named the Volume Table of Contents and called the "VTOC" is also placed on the disk. This guide enables us to find and retrieve our files. Think of this VTOC as a road map. Highways and cross streets enable us to find our way to various parts of the disk.
   c) The track and sector markers that are placed on the disk can be read by the computer programmers. For our purposes we can think of these track and sector markers as street signs and highway indicators.
2. Have students format a disk. Tell them that they can erase the contents of an old disk by this process as well. Caution them to make sure the disk in the drive is

the one that they want formatted. Suggest that this be done with all other disk drives empty, as a precaution. Remember a computer is simply a piece of electronic equipment and while very reliable, it is just a machine. Remind students how many of their precious files are on these data disks and how much hard work would have to be put forth to recreate all these files. Losing the program disk could be another possible disaster. Think of the cost involved in replacing the software. Formatting a blank disk is unique to the version of VisiCalc that you are using and to the type of computer you are using it on. The IBM VisiCalc program comes on a disk that does not include the operating system. It is therefore necessary to initialize all disks according to your computer manual and not within the VisiCalc program. There are versions of VisiCalc that do come with the computers operating system built in. If you are using one of these versions you will be able to initialize your disks with the STORAGE COMMAND. The option is I for initialize and "/SI" is the necessary command.

3. Saving our files on disks is one way of preserving our data. Are there any other ways? Elicit the need for the PRINT COMMAND. Teach students the phrase hard copy. When we save our files on a disk we say we are creating a soft copy. When we use the VisiCalc program we say we are using software. When we print a copy of our files we say we are creating a hard copy. The hardware that we are using is called a printer. The computer, the drives and the monitor are other examples of hardware. The following is a definition taken from Websters' New World Computer Dictonary.

- Hard copy: Computer output that is printed on paper and can be read and handled by people: A hard copy is opposed to other computer output that may be temporarily displayed on a terminal or recorded on another medium such as magnetic tape.

To print the files on the printer it is important that the printer be turned on. Make sure students are aware of all that is necessary to know about turning on the printer. For most printers there is an on/off switch and a select button as well. It is not necessary to initialize the printer. The VisiCalc program will give the printer the proper signal when we access the PRINT COMMAND. If for some reason the Printer is off or not selected, the program will halt execution.

4. Before we can think of printing our worksheet we must know certain things about the paper we are using. Most printer forms provide room for 80 characters of normal print mode in the width and 66 lines of print in the length. VisiCalc lets us customize the reports we print. The process of printing a worksheet is called printing a report. Deciding whether to single, double or triple space the lines, what type of print to use, and what heading to use is the process know as customizing the report.

- Note to teacher: VisiCalc also provides options that permit you to customize the spreadsheet for the particular printer that you are using. You can change type, print compressed or enlarged, or use emphasized mode. This is done by sending special characters to the printer. The correct characters can be found in your printer's manual. A discussion of the commands that seem to apply to most printers follows shortly. It depends on a brief knowledge of the hexadecimal system of numeration. A discussion of Base 16 numerals with the class is left to the discretion of the individual teacher. If the class is anxious to use the different styles of type and unable to understand the number theory, giving them the number, without any explanation, will be sufficient.

5. To enter the print command press "/P". The display on the command line becomes:
(PRINT: FILE, PRINTER)
We want to print our worksheet so we choose the printer option and type "/PP". Caution students to be very careful with the width of the spreadsheet. If you are attempting to print 10 columns of 9 characters each you

will have a serious problem. 90 characters is much too wide to display on a standard 80 column printer. One way to solve this problem is to press escape and return to the spreadsheet to do some editing. You can now adjust column widths. If not too much data is included in each column they can all be changed to 7 characters each. Ten columns of 7 characters each is only 70 characters, well within our 80 column limit. If there is too much data in the worksheet and all must be printed then printing two separate rectangles is suggested. The papers can be joined or taped together at a later time.

a) Create any sheet of data for the students to print. It can be one previously stored or a new one created during this lesson. Let us assume this file has 10 columns of 7 characters each. The first data cell is A1 and the lower right cell is J20. The spreadsheet is composed of 10 columns and 20 rows. We have already determined that our paper width is sufficient to print 70 characters across, and now we must consider the length of the page. The default spacing for VisiCalc is double spacing. A line is skipped between every VisiCalc row. Twenty rows and twenty spaces indicated that 40 lines will be printed. The standard page length is 66 lines, we are again well within our limits. Before we access the print command we must position our cursor in the upper lefthand corner of the report that we wish to print. In this case we want to print the complete sheet so we position our cursor at A1. We access the command with "/PP".

   The display on the command line changes to:

   (PRINT: Lower Right, "Set Up, -, &)

   If we choose to print the sheet as we see it, double spaced, with no title or page heading we simply give it the lower right coordinates. In this case J20. We can either point the cursor at J20 or type in the coordinates. As soon as these coordinates are entered the printer is activated and the sheet is printed. Typing BREAK(SCR LOCK) will stop the execution of the printer.

b) If you wish to change the spacing to single spaced output you can do so with the "-" option of the PRINT COMMAND. Pressing this character turns off the line feed that is sent with each carriage return. Before you type the lower right coordinates, type the "-" key. No display will follow the depressing of this key but VisiCalc will get the message. There is no need to press the Return key after the "-" is pressed, simply type "/PP-J20" and your report will be printed single spaced. The single spacing will be in effect until the computer is turned off or the "&" character is encountered. This character sends a line feed with each carriage return and thus results in double spacing. Have students reactivate the line feed and print a small portion of the sheet. Position the cursor at D10 press "/PP&H15". A small rectangular section of the sheet is printed with double spacing.

c) The set up option is accessed with the " keystroke while in the Print Command. This option enables us to send special characters to our printer, print Titles and print page headings. Have the class print the Title SCHOOL BUDGET on the worksheet. Any applicable title may be used. Type /PP", as soon as the quotation mark is printed the command line changes to:

(PRINT: Setup or Enter)

Pressing Return will send back the earlier display, we are in Set Up mode and nothing further has to be pressed. We are given the option however of changing our mind and pressing return. The cursor flashes on the edit/entry line. Type SCHOOL BUDGET. It is now necessary to indicate to VisiCalc that a carriage return is requested. Without the carriage return the Title (SCHOOL BUDGET) will be printed on the same line as the first row of the spreadsheet. Typing R will send a carriage return. It is time to reiterate the procedure. To print a report including the rectangle from A1 to J20, single spaced, with the

Title SCHOOL BUDGET on its own line, enter the following sequence of keys.
/PP-" SCHOOL BUDGET^R Return J20. If you wish to center the Title over the spreadsheet include about 20 spaces before you print SCHOOL BUDGET. To skip a line between the Title and the spreadsheet include a second ^R, before you press return. Other Setup characters that can be sent to the printer at this time are:

Actual character	VisiCalc	Example	Definition
The CTRL key	^C	^CD	CTRL-D
The ESC key	^E	^EQ	ESC Q
CARRIAGE RETURN	^R	^R^R	sends two carriage returns
Line feed	^L	^L^L^L	sends 3 line feeds
The caret	^	^^	sends a caret character
A 2 digit hex numeral	^H	^H0E	The hexadecimal numeral 0E or the decimal numeral 14

- These printer codes can be used to change the type. Let us assume that the printer code for compressed pitch is ESC Q, and the code for proportional pitch is ESC P. We wish to print the title in compressed pitch and the spreadsheet in proportional pitch. The following sequence is all that is needed.
  /PP"^EQ SCHOOL BUDGET ^EP^R^R.
  The title will be printed in compressed pitch, the spreadsheet in proportional type.
- Assume the code to turn on elongated type is the hexadecimal numeral 0E and 0F to turn it off. To print elongated Title and a proportional spreadsheet use.
  /PP"^H0E SCHOOL BUDGET ^H0F ^R.

6. The File option of the PRINTER COMMAND is used to save a file exactly as it appears on the screen. The files are saved without formulas and references. Just as the file is sent to the printer (we see no formulas on our hard copy), the file can be sent to the disk drive. Once a file is saved in this manner it cannot be loaded with the LOAD option of the STORAGE COMMAND. Attempting to load

such a file will result in the inability of VisiCalc to continue. The disk will probably have to be rebooted. There are several advantages to programmers to create a file in this manner. I suggest avoiding this topic, if students are curious the above explanation should satisfy them.

7. Worksheets can be neatly formatted by using the repeating label command. This command is accessed with "/-". Any character that appeals to the students may be used. Lines created with the minus signs, or a string of X's can be accessed and used to separate differenct sections of the worksheet. Load the MYGRADES file and insert a row after the Titles. Position the cursor in A2. Access the REPEATING LABEL COMMAND with "/-- Return." Cell A2 is filled with a line of dashes. Replicate this with "/R Return B2.H2 Return". Print the sheet with the title in elongated type and the spreadsheet in compressed type. The result is printed below.

MYGRADES

SUBJECT	TEST 1	TEST 2	TEST 3	TEST 4	TEST 5	TEST 6	AVERAGE
ENGLISH	90	85	87	90	90	95	89.5
HISTORY	90	85	91	95	90	95	91
HYGIENE	95	89	90	92	100	10	79.333
MATH	65	65	65	72	80	95	73.667
MUSIC	80	80	75	85	80	85	80.833
SCIENCE	67	65	70	72	78	88	73.333
SPANISH	72	75	70	80	80	90	77.833
TYPING	99	100	100	100	100	100	99.833

8. Permit students to print some of their worksheets. The files that the class has been saving can now be recalled and printed. Since only adjacent rows and columns can be printed the MOVE COMMAND is suggested. Print portions of the spreadsheet. Remember to position the cursor in the upper left corner of the desired rectangle. Inserting blank columns and rows is a technique used to simulate margins. Use the repeating label command and change types and spacing.

9. If student disks become overcrowded with useless files it may be a good idea to delete some of these old files from their diskettes. The process of deleting a file from a disk is used when the file is no longer needed. When a file is deleted the file name is erased form the catalog and it becomes impossible to find and load this file. Be sure students understand the difference between the DELETE COMMAND which erases rows and columns and the DELETE option of the STORAGE COMMAND which irretrievably erases a file from a disk. The command is accessed with "/SD". The command line prompts.
   (STORAGE: File to delete)
   You have the option of typing the name of the file you wish to delete or using the → to examine the catalog, and press Return when the desired file name appears on the edit/entry line. As soon as you press Return the command line displays Delete File: Type Y to confirm. If a "Y" is typed, the file is deleted, if any other key is typed the STORAGE COMMAND is cancelled.

10. The proper way to exit the VisiCalc program is with the Quit option of the STORAGE COMMAND. To access this command type "/SQ". The command line reads:
    (QUIT: Type Y to confirm.)
    Most computers will reboot in response to typing "Y". If you are planning on using another disk, it should be in the drive before you type the "Y". If you are finished using the computer, simply turn it off.

APPLICATIONS:

1. It is now time to print all the files we have been creating and saving since we began learning how to use the spreadsheet. The files should be loaded, column widths adjusted, repeating labels added, rows and columns inserted for neat formatting and headings added.

2. The multiplication table and the sheet of fractions, decimals and percents can be printed at this time. These tables can be pasted in student notebooks. Large groups of data can be transformed into hard copy if printed in compressed mode and single spaced.

3. Students should have experience deleting files from data disks. Nonsense files can be created quickly and saved. This will afford practice deleting files. Make sure the correct disk drive is in effect and observe all the precautions outlined in the lesson before any files are deleted.

4. Some keystrokes have multiple uses. Have the class create a list of these keys. The " is used to indicate a label that would otherwise be interpreted as a value. It is also used to indicate the Setup in the print command. The - key is used to access the repeating label command and for single spacing in the print command. The D in the Delete command and the Delete option of the Storage command.

5. A copy and explanation of the spreadsheet commands which has been taken from the VisiCalc Manual is included for review. This sheet can be duplicated for each student. If time permits students can make their own.

SUGGESTIONS FOR LAB SESSIONS:

- If the printers are available to the students then there are many activities that will give them the necessary practice.
  - a) Creating reports (school).
    1. Student program.
    2. Student report card.
    3. Daily schedule.
    4. Special room directory.
    5. Vocabulary lists.
  - b) Creating reports (home).
    1. Names and addresses.
    2. Allowance, earnings and budget.
    3. Phone list.
    4. Library lists.
    5. Projected vacation costs.
    6. Mileage charts.

- Students must be encouraged to preplan the report. Discussing the size of various fields can be very helpful. Questions such as:

  How many characters will I need in a last name field? A first name field? A field that contains a grade? A phone number? A zip code?

  Will be helpful to students when planning the report. Spacing must be taken into consideration. If each field is packed with characters then words will fuse together and the report will be unclear.

- Discuss how to format the following report. Last name, First name, official class, 6 tests, 1 average column.

SUMMARY:

1. Where can I find a soft copy of a file that I created? (On a disk or a video display.)
2. Why is printed computer paper called a hard copy?
3. Can you name three types of computer hardware?
4. Is a spreadsheet program an example of hardware or software?
5. Why do we initialize blank disks?
6. What happens to a used disk when it is formatted by the VisiCalc program?
7. What is the planten width of our printer?
8. How many characters can be printed on one line?
9. What is the default lines per page?
10. How can I access the repeating label command?
11. How can I print a spreadsheet singly spaced?
12. What is the difference between the delete option of the storage command and the delete command?

HOMEWORK:

1. Describe in your own words what is meant by the following phrases.

a) Making a hard copy.
b) Creating software.
c) Making a soft copy.
d) Taking inventory of the hardware.
e) Customizing a report.

2. Describe the function of the following keystrokes when in the Print Command.
   a) -
   b) &
   c) "

3. Does the position of the cursor matter when accessing the following commands? Explain!
   a) The Print Command.
   b) The Storage Command.
   c) The Format Command.
   d) The Global Command.
   e) The Replicate Command.

4. How are old files deleted from the disk?

5. Name the keystrokes you would use to access the command that will:
   a) Fill a cell with percent signs.
   b) Print a report.
   c) Exit the VisiCalc program.
   d) Delete a row.
   e) Right justify a title.
   f) Edit a formula.
   G) Clear the worksheet.

HOMEWORK SOLUTIONS:

1. a) Printing a report on paper.
   b) Writing a computer program.
   c) Saving a file to a disk or loading a file to a monitor.
   d) Cataloging printers, computers, drives, monitors.
   e) Determining column widths, margins, spacing, titles.

2. a) Turn off line feed.
   b) Turn on line feed.
   c) Access Setup.

3. a) Yes, upper left hand corner of desired rectangle.
   b) No, the entire worksheet is saved.
   c) Yes, the entry to be formatted.
   d) No, the global change is for the entire sheet.
   e) Yes, it is the beginning of the source range.

4. /SD and enter filename type Y.

5. a) /-%
   b) /PP
   c) /SQ
   d) /DR
   e) /FR
   f) /E
   g) /CY

COMMANDS

/B Blank - Erases the highlighted entry position. or arrow key completes command.

/C Clear - Clears the worksheet, restores the General format and single window. Y completes command, any other key cancels.

/D Delete - Deletes all the entries in the row (/DR) or column (/DC) on which the cursor rests.

/E Edit - Allow editing of entry position contents. Places the contents of the highlighted entry position the edit line. The left and right arrow keys (and) move the edit cue over the characters without changing them. The arrow key moves the edit cue to the beginning of the edit line; the arrow key moves the edit cue to the end of the edit line. Enter or delete to the left of the edit cue. CTRL-E invokes the Edit Command while entering values and labels.

/F Format - Sets local format for the highlighted entry position but does not affect contents in memory. Remains until changed or the worksheet is cleared.

- /FD Default - Resets to the global format.
- /FG General - Maximum precision.
- /FI Integer.
- /FL Left-aligned.
- /FR Right-aligned.
- /F$ Dollars-and-cents (two decimal places).
- /F* Graph - Replaces value with asterisks equal to its integer value.

/G Global - Affects entire window or sheet.

- /GC Column - Sets column width of all columns to specified number. completes command.
- /GF Format - Sets display format for all entry positions not specifically formatted. See /F for format specifications.
- /GO Order of recalculation - Specifies whether the worksheet is to be recalculated down the columns (/GOC) or across the rows (/GOR).
- /GR Recalculation priority - Sets recalculation to automatic (/GRA) or manual (/GRM). Typing! causes recalculation.

/I Insert - Inserts a new blank row (/IR) or column (/IC) at the cursor position.

/M Move - Moves an entire row or column to another position on the sheet. The first coordinate on the edit line.

/P See "Printing."

/- Repeating Label - Fills the entry position with the designated character(s).

/R See "Replicating."

/S See "Storing."

/T Titles - Fixes rows and columns in place on the screen so they remain in view when the window is scrolled. The position of the cursor determines which column(s) and/or row(s) to be fixed. The Go To command ( ) moves the cursor into a fixed area.
  - /TH Horizontal - Fixes rows at and above the cursor.
  - /TV Vertical - Fixes columns at and to the left of the cursor.
  - /TB Both - Fixes columns and rows.
  - /TN None - Unfixes all rows and columns.

/V Version - Displays the copyright notice and version number on the prompt line and the serial number on the edit line.

/W Windows - Splits the screen vertically or horizontally at the current cursor position. The semicolon (;) moves the cursor from one window to the other. Global commands affect only the window containing the cursor.
  - /WH Horizontal - Splits the screen just above the row with the cursor.
  - /WV Vertical - Splits the screen just to the left of the column with the cursor.
  - /W1 One - Returns to one window.
  - /WS Synchronized scrolling - Split windows scroll together.
  - /WU Unsynchronized scrolling - Cancels synchronized scrolling.

PRINTING

The print command sends a rectangular portion of the worksheet to a printer or to diskette. Formulas are not sent (to print formulas and formats, see /SS).

To print all or part of a VisiCalc worksheet:

1. Place the cursor in the upper-left coordinate of the rectangular area to be printed and type /P.

2. To send data to a printer, if you want to use the same printer or you only have one printer, type P.

   To send data to a device other than the default printer, type F. Then you can do one of the following:

   If you want to specify a specific printer, type LPT1: or LPT2: or LPT3:

   To send data to a diskette file, type the filename when asked for filename.

   To send data to a serial communication port type COM1: or COM2: when you are asked for filename.

   Note: You can select the baud rate you want to use (the program uses 300). To select a baud rate other than 300 type B followed by 110, 600, 1200, 2400, 4800 or 9600.

3. To send set up codes, type ", the codes, then press ↵ . The following special characters can be used:

^ C char	Sends next character as a control character.
^ E	Sends the Escape character.
^ Hnn	Sends the single ASCII character defined by the hexadecimal digits nn. Note: Use ASCII codes for your particular printer.
^ R	Sends a return character.
^ L	Sends a line feed character.
^^	Sends one caret character (^).

The set up codes must be reentered each time the Print command is used. Invalid codes are sent to the printer - no error indication is given.

4. The VisiCalc program automatically sends a line feed with each carriage return.

   `-` Turns off the line feed.

   `&` Restores line feed.

5. Enter lower-right coordinate of the rectangle to be printed, either by typing it or pointing the cursor to it, and press ↲.

REPLICATING

The Replicate command copies the entry contents of the source range (the position(s) to be copied) into the target range (the position(s) to which it will be copied).

A range is a portion of a row or column specified by its beginning coordinate, a period (shown as an ellipsis), and its final coordinate.

A colon separates the source range from the target range and is entered by typing either colon or ↲.

	Source		Storing
To copy one entry once.	coordinate	:	coordinate
To copy one entry several times.	coordinate	:	range in same row or column.
opy a row or or column once.	row or column range	:	starting coordinate.
To copy a row several times.	row range	:	range in same column.
To copy a column several times.	column	:	range in same row.

↲ completes command.

If the source range includes reference to other locations, indicate how each reference is to be treated:

N	No Change - Copies the reference as it appears in the source entry.
R	Relative - Changes the reference so that it is relative to the target position.

STORING

The Storage command writes a file to diskette, reads a saved file from diskette, writes and reads files in the DIF™ format, deletes files from a diskette, and quits the VisiCalc program. File names can be displayed from the diskette by pressing the right arrow key when prompted for file name.

/SL	Load - Reads a file previously saved with /SS. The file is loaded over the current sheet. New entries replace old ones. Any entries that are not replaced remain the same. To load a file into empty worksheet, clear with /C before loading new file.
/SS	Save - Saves the information on the worksheet on diskette under the specified file name. To print out formulas and formats type /SS,P.
/SD	Delete file - Deletes the specified file from the diskette.
/SQ	Quit - Quits the VisiCalc program, and returns to DOS.
/S#S	Writes the specified area of worksheet to diskette as a file in the DIF™ format. R or ↵ saves by rows, C saves by columns.
/S#L	Loads a file in the DIF™ format. R or ↵ loads the information by rows, C loads by columns.

CONSUMER MATHEMATICS

CALCULATORS

LESSON: 2L

AIM: How do we use the power of the electronic spreadsheet to calculate squares and square roots?

PERFORMANCE OBJECTIVES: The student will be able to...

1. Use the built in function SQRT() to find the square root of a number.
2. Find squares by:
    a) Multiplying a number by itself (N*N).
    b) Using the ^ to indicate exponentation (N^2).
3. Round square roots to the nearest integer using the:
    a) Global format integer option. (VisiCalc)
    b) Fixed decimal value format. (Appleworks)
4. See how the spreadsheet remembers the precise value by returning values to their original state with the:
    a) Global format general option. (VisiCalc)
    b) Appropriate value format. (Appleworks)
5. Create a table of squares by:
    a) Using the replicate command to speed calculations.
    b) Left justify values for clarity.
    c) Insert 2 rows on top for labels and delineation.
    d) First format, then replicate to save steps.
    e) Print a single spaced worksheet with a title.

VOCABULARY: square, square root, replicate

MOTIVATION:

We have seen how quickly square roots can be found using the calculator. It would be very convenient if we had a list of squares and square roots to paste in our notebooks. Do you think we could prepare a list of the first fifty squares and square roots this period? How do you suggest we accomplish this in the shortest time possible? Hopefully the student will remember that although a calculator will find one square or square root quickly to find 50 squares or square roots quickly we need the power of an electronic spreadsheet.

DEVELOPMENT:

1. Establish the need to use the replicate (copy) command to create this table. Plan a neat orderly table. Use three columns. One each for the number, the square and the square root. Plan the titles and draw lines for separators. Plan the formulas.
   - a) The formula to generate the numbers. Each number will be one more than its predecessor. If we begin in A1 then the formula will be +A1+1.
   - b) The formula to generate the square of the number. Use either +A1*A1 or +A1^2. Review the "*" the symbol used by the computer for multiplication or the "^" the symbol used for exponentation.
   - c) The formula to generate the square root. Use the built in function SQRT().

2. Enter a (1) in cell A1. Position the cursor in cell A2 and enter the formula (+A1+1). A "2" will appear in A2. Position the cursor over the "2" in cell A2. Prepare to replicate this formula from cell A3 through cell A50, thus generating the first 50 positive integers.

- Appleworks:
  - A1) (Open Apple-C) - To access the Copy Command.
  - A2) (Return, Return) - To choose within worksheet.
  - A3) (↓, Period, depress ↓ to A50, Return) - For target range.
  - A4) (→, Return) - For relative change.
- VisiCalc:
  - V1) (/R, Return) - To access the replicate command.
  - V2) (A3.A50, Return) - To enter the target range.
  - V3) (R) - To indicate relative change.

Column A should now contain the numbers 1 through 50.

3. Position the cursor in B1 and type (+A1^2, Return). A "1" should appear in B1. Leave the cursor over the "1" in B1 and prepare to replicate the formula to find the

squares of the first fifty positive intergers.

- Appleworks: Follow steps A1...A4 above, adjust cell numbers.
- VisiCalc: Follow steps V1...V3 above, adjust cell numbers.

4. Position the cursor in C1. Type@SQRT(A1), Return. A "1" should appear in C1. Leave the cursor over the "1" in C1 and prepare to Copy the built in function thus finding the square root of he first fifty positive integers.
   - Appleworks: Follow steps A1...A4 above.
   - VisiCalc: Follow steps V1...V3 above.

5. Round numbers to the nearest hundredth.

- Appleworks:
  - A1) (Open Apple-L) - To access the Layout Command.
  - A2) (➤, ➤) - To choose column.
  - A3) (Return, Return) - To choose value format.
  - A4) (Return, Return) - To choose Fixed Decimal.
  - A5) (2, Return) - To choose the hundredth column.

  Appleworks rounds numbers to the specific column. To round to tenths you would choose 1, and 0 to round numbers to the nearest integer.
- VisiCalc: The only rounding that VisiCalc does with the Format or Global Commands is, to the nearest integer with the "I" option. We get around this by changing the column widths. Fortunately when VisiCalc changes column width it also rounds. The procedure is to access the column option of the Global Command and change the width to 5 characters (/GC5). We may also use the "$" option of the format command.

6. Insert a row at the top for the purpose of entering the titles of each column. Position the cursor in the first row.

- Appleworks:
  - A1) (Open Apple-I) - To access the insert function.
  - A2) (Return) - To choose only the first row.
  - A3) (1, Return) - To insert one row.

- VisiCalc:
    V1) (/IR)

7. Type the labels. Enter NUMBER in A1, SQUARE in B1 and SQ. ROOT in C1. Agree to right justify the labels for clarity and appearance. Our worksheet contains only the three labels that we are going to right justify. Numbers are all right justified. If we make this a global change we can change all three labels at once and not interfere with the numbers.

- Appleworks:
    A1) (Open Apple-V) - To access the Standard Value Command.
    A2) (➤, Return) - To choose label format.
    A3) (➤, Return) - To right justify.
- VisiCalc:
    V1) (/GFR)

8. For a neat format choose a divider between the titles and the numbers. Position the cursor in the second row and follow the insert procedure outlined in step 6. A blank row now appears in row 2 and all data has moved to row 3 and below. For the dividing line:

- Appleworks: There is no special command that Appleworks uses for this procedure. Simple depress the minus key and hold it down until a line is draw in the required region. You will have to use the " key to inform Appleworks that this is a label and not a value. Remember when the spreadsheet sees the " key it automatically assigns label. You may choose to continue to review the copy command with the class. In that case position the cursor over A2. Press the " key and then the minus key. (", -) Hold the minus key down until the full column width has been filled with that character. Press Return and leave the cursor over cell A2:
    A1) (Open Apple-C) - To access the Copy Command.
    A2) (Return, Return) - To choose within worksheet.
    A3) (➤, Period, ➤, Return) - To complete target range.

- VisiCalc: Position the cursor in cell A1:
  - V1) (/-) - To access the Repeating Label Command.
  - V2) (-, Return) - To choose the character that you wish to repeat.
  - V3) (/R, Return) - To choose the Replicate Command.
  - V4) (A2.A3) - To choose the target range.

9. Print the worksheet with single spacing and a title.

TABLE OF SQUARES AND SQUARE ROOTS

NUMBER	SQUARE	SQ. ROOT
1	1	1
2	4	1.41
3	9	1.73
4	16	2.00
5	25	2.24
6	36	2.45
7	49	2.65
8	64	2.68
9	81	3
10	100	3.16
11	121	3.32
12	144	3.46
13	169	3.61
14	196	3.74
15	225	3.87
16	256	4
17	289	4.12
18	324	4.24
19	361	4.36
20	400	4.47

- Appleworks:
  - A1) (Open Apple-P) - To access the Print Command.
  - A2) (Return) - To choose "All".
  - A3) (Return) - To choose your printer.
  - A4) (Return) - Or insert data and then Return.
  - A5) (Return) - To print only one copy (or change number) and begin printing.

- VisiCalc:
    - V1) (/PP) - To access the printer option of the Print Command.
    - V2) (-, ") - To change to single spacing and choose Setup.
    - V3) (Titlename, ^R, Return) - To print title name.
    - V4) (C53, Return) - To choose lower right cell.

APPLICATIONS:

1. Round square roots to different accuracies. Return to the original format to see how the spreadsheet remembers the original input.

- Appleworks: Choose fixed decimal format of 6.
- VisiCalc: (/GFG) The general option of the Global, Format Command.

2. Change the formula that was used to create the number column. Select multiples of three, five or eight. Do this by changing cell A3 to "3". Change the formula to (+A3+3). Follow the instructions to replicate this formula and the spreadsheet will take care of changing all the calculation. Review with class the spreadsheet's default Automatic calculation. Continue as time permits, changing cell A3 to 5 and the formula to (+A3+5), or A3 to 8 and the formula to (+A3+8).

SUMMARY:

1. Is it possible to use the spreadsheet to find the square of one number?
2. Is it practical to use the spreadsheet to find the square root of one number?
3. What would be a good rule to follow when choosing between using a calculator or an electronic spreadsheet? (Assume both are readily available.)
4. What keystrokes would you use to round a column of values to the nearest hundredth?
5. Where must I position the cursor when replicating a formula?

HOMEWORK:

1. Use the table that was prepared in class to answer the following:
   a) The square root of 28.
   b) The number 28, squared.
   c) The square root of 784.
2. Find the square root of 13 and round your answer to the nearest tenth.
3. How many perfect squares are there in numbers from 1 to 25? Name them.
4. Find the answers:
   a) 10 2
   b) 20 2
   c) 300 2
   d) 700 * 700
   e) 1200 * 1200
5. a) Write a rule to find the square of a number that ends in one or more zeros.
   b) Write a rule to find the square root of a number that ends in an even number of zeros.
6. Describe how you would use the spreadsheet to:
   a) Generate ten multiples of seven in column B, given a "7" in cell B5.
   b) Find the square of each number in column B and place it in column C.
   c) Find the square root of each number in column B and place it in column D.

HOMEWORK SOLUTIONS:

1. a) 5.29
   b) 784
   c) 28
2. 3.6
3. Five, 1,4,9,16,25

4. a) 100
b) 400
c) 90,000
d) 490,000
e) 1,440,000

5. a) Double the number of zeros and square the non-zero part.
b) Halve the number of zeros and find the square root of the non-zero part.

6. a) Position the cursor in B6. Type +B5+7, Return. Replicate the formula with:
- Appleworks: (Open Apple-C, Return, Return, ↓ , Period, ↓ to B14, Return, →, Return)
- VisiCalc: (/R, Return, B7.B14, Return, R)

b) Position the cursor in C5. Type +B5^2, Return.
- Appleworks: Same routine as part A.
- VisiCalc: Same routine as part A.

c) Position the cursor in D5 type SQRT(B5), Return.
- Appleworks: Same routine as part A.
- VisiCalc: Same routine as part A.

CALCULATORS

LESSON: 8L

AIM: In what order does the electronic spreadsheet perform calculations?

PERFORMANCE OBJECTIVES: The student will be able to...

1. Determine through experimentation that the spreadsheet gives no operation precedence in order of calculations.
2. Discover that the spreadsheet calculates by:
   a) Treating portions of a formula in parentheses first.
   b) Working the innermost of nested parentheses first.
   c) Calculating from left to right.
3. Write formulas in such a way as to force the spreadsheet to give us a correct answer:
   a) 2 + 3*4 + 5 = 25, wrong
      2 + (3*4) + 5 = 19, correct
   b) 3 + 4/2 = 3.5, wrong
      3 + (4/2) = 5, correct
4. Correct errors caused by moving data that requires a specific position in a formula:
   a) Due to forward reference, when a formula contains a reference to an entry that is recalculated after the answer cell.
   b) When the answer to the sum of a range of data is positioned inside the range.
   c) Forcing a recalculation.
5. Develop skill moving data and forcing recalculations.

VOCABULARY: order of operations, nested parentheses, recalculation, forward reference

MOTIVATION:

What is the answer to 3 + 2*5?
- Does it matter if we say 3 + 2*5 or 2*5 + 3?

DEVELOPMENT:

1. After a preliminary discussion establish that we can accept only one answer to an arithmetic problem. The order of operations that we accept will be multiply or divide first and add or subtract last. Thus both examples in the motivation will yield the same answer. (13) 3 + 2*5 or 3 + 10 and 2*5 + 3 or 10 + 3

- Ask students if they think the spreadsheet knows the order of operations. Let them experiment. Position the cursor over A1 and type 3 + 2*5 Return. Move the cursor to B1 and type 2*5 + 3 Return. The class may be surprised to see a 25 in A1 and a 13 in B1. Explain that the spreadsheet gives no operation precedence in order of calculation. The rule that the spreadsheet follows is to calculate the operations inside parentheses first. Questioning should proceed in the following manner:
- If you saw the example 3 + 2*5, what would you do first? (Multiply)
- How can we teach the spreadsheet to multiply the 2 and the 5 first? (Use parentheses.)
- Insert parentheses in these examples to force the spreadsheet to yield the correct answer.

  2*5 + 3   Ans. (2*5) + 3
  3 + 2*5   Ans. 3 + (2*5)
- Position the cursor over C1 and type (2*5) + 3 Return. Position the cursor over D1 and type 3 + (2*5) Return. This time the correct answer 13 appeared in both cells.
- Students should also be encouraged to try: (3 + 2)*5 and 2*(5 + 3)

2. Pose problem: What is the only answer to 6 + 6/3? (8). What answer will the spreadsheet find? (4) How can we enter this problem to force the spreadsheet to give us the correct answer? (6 + (6/3)). Repeat the same line of questioning with 9 - 6/3. (The correct answer is 7, the spreadsheet will give us a 1, unless we enter (9 - (6/3)). Develop rule: Use parentheses to direct the spreadsheet to the operation you want calculated first.

3. Clear the spreadsheet, position the cursor over A1, enter 5 + (D1*2). A "5" will appear in A1. There is no value in D1 and the spreadsheet has assumed that a zero was entered. Place a "5" in D1 and watch the value in A1 change to 15. Next position the cursor over D1 and enter 5 + (A1*2). The display in A1 has changed to 75 and a 155 appears in D1. Leave the cursor over D1 and force the spreadsheet to recalculate by pressing the "Open Apple-K (Appleworks) "!" key (VisiCalc). A1 changes to 315 D1 changes to 635. Move the cursor to A1 and force another recalculation with "!" or Open Apple-K. A1 changes to 1275 and D1 changes to 2555. The students should be made aware how these two values depend on each other. Let them predict the results of the next recalculation. Begin with the value in D1. Multiply it by 2 and add 5. The result will be 5115. This is the value that will appear in A1. The value in D1 will change also. The D1 value will be based on this new A1 value. 2*5115 = 10230+5=10235, the value in D1. Force the recalculation and have students see that their prediction was correct. Forward reference and circular reference may be discussed at this point if the teacher feels the class is ready for such a discussion.

4. Pose the problem: 2*(4+(3*2))?
   Ask students how they think the spreadsheet would carry out the calculations. Teach them the phrase "nested parentheses". The rule for calculating examples that contain nested parentheses is to calculate from the inside out. The spreadsheet knows how to do this. First it calculates what is in the inner parentheses (4+(3*2)) or 4+6=10. The problem is reduced to 2*(10) or 20. Ask students to consider the following change. (2*4)+(3*2) Are these nested parentheses? (no) Is the answer still 20? (no, 8+5=13) Reinforce this concept with:
   3*(8-(15/3))? (9)

5. Develop the concept of working from left to right. If there are no parentheses in an example, the spreadsheet calculates from left to right. Find the answer to

5 + 3 - 2 + 4? (10) Try (5+3) - (2+4)! (2)

- The formula to find the perimeter of a rectangle is P = 2*l+2*w. Let us assume that we place the length "l" of the rectangle in A1 and the width "w" in B1. We plan to use the formula P = 2*A1 + 2*B1. Consider the display:

	A	B	C
1	6	5	

What is the perimeter of the rectangle with length 6, and width 5? (22) If you position the cursor over C1 what formula must you type, that will result in 22? Hopefully the students will remember the parentheses. If they do not, let them try, 2*A1+2*B1, which equals 70. The correct answer is (2*A1)+(2*B1).

6. Understanding how the spreadsheet calculates is the vital to the correct planning of reports. Consider the following display:

	A	B	C	D	E	F	G
1	NAME	MON	TUE	WED	THURS	FRI	
2	Joe	1	2	3	4	5	13

The data in G2 was determined by the formula @SUM(C2...F2)-B2. If the data in G2 is moved to E2 the number 13 changes to 26. Have students try this.

VisiCalc: To move the contents of G2 to E2, position the cursor over G2, enter (/M, E2, Return).

Appleworks: To move the contents of G2 to E2, position the cursor over G2, enter (Open Apple-M, Return, →, Return, Return, ←, ←, Return.

Positioning the cursor over E2 reveals the problem. The formula that appears on the cell indicator line is SUM(C2...G2)-B2. The answer, which now appears in E2, is positioned in the interior of the example. This is an example of circular reference. The answer is calculated using itself as one of the numbers in the example. Next move the contents of E2 (which was originally in G2) to B2, and see the answer correct to 13 again. Elicit, the answer is no longer part of the example.

APPLICATIONS:

1. The formula used earlier in the lesson to calculate the area of a rectangle could have been written P = 2*(l+w). If using this formula with the spreadsheet is it necessary to enter the parentheses? Explain?
   Correct form 2*(A1 + B1), without the parentheses only A1 would be doubled.

2. Describe how the spreadsheet would calculate 2*3+4*5?
   The spreadsheet calculates from left to right and gives no operation precedence. It will calculate operations in parentheses first. This example would be calculated in the following manner: 2*3=6+4=10*5=50. The correct way to do this is 2*3=6, 4*5=20, 6+20=26. Have students explain how this example should be entered so that the spreadsheet would be forced to give the correct answer.
   a) No variables (2*3)+(4*5).
   b) With variables (2*A1)+(4*B1).

3. When the spreadsheet encounters a numerical expression enclosed in parentheses it looks at the different symbols as representing one specific number. (5-3) is a group of symbols that means 2, to the spreadsheet, and (5+3) is a group of symbols that means 8. In mathematics we say (5-3) represents the number 2 and (5+3) represents the number 8. The following exercises can be placed on the board, or duplicated for each student. Have students:
   a) Find the correct answer to each problem.
   b) Predict the answer that the spreadsheet would find.
   c) In the event that parts a and b are not equal, rewrite the example to force the spreadsheet to find the correct answer.
   d) Use the spreadsheet to determine if their predictions, calculations and rephrasing have been done correctly.

   Samples:

1)	3+7*5	a) 38	b) 50	c) 3+(7*5)
2)	3*7+5	a) 26	b) 26	c) no rephrasing necessary.

Examples:

1)	7+9/3	(7+(9/3))
2)	27-3*2	(27-(3*2))
3)	8+12/6-2*5	(8+(12/6)-(2*5))
4)	18/3-2	no rephrasing necessary.
5)	5+6*2-8	(5+(6*2)-8)

4. Practice with nested parentheses can be a valuable experience for students. The following examples can be calculated by students and then checked with the spreadsheet.

   a) 2*(16-(10/5))
   b) 3*((18/3)-(12/4))
   c) 15/(4+(22/2))
   d) 25-((15*2)-(7*4))
   e) 17-((32/4)-(6+2))

SUMMARY:

1. Is there an order that mathematicians use when calculating an arithmetic example? What is it?
2. Do all calculation on the spreadsheet follow the rules of order that the mathematicians recommend?
3. What is the spreadsheet programmed to calculate first?
4. How do we indicate to the spreadsheet that we want a specific operation calculated first?
5. What is the correct way to calculate parentheses that are nested within other parentheses?
6. Can answers change when data is moved to other locations on a spreadsheet?
7. What are some restrictions we must observe before we attempt to move data on the spreadsheet?
8. If we suspect that the spreadsheet shows an incorrect answer and we wish to force a recalculation, what key must we press?

HOMEWORK:

1. For each of the following:
   a) Find the correct answer to each problem.
   b) Predict the answer that the spreadsheet would find.
   c) In the event that parts a and b are not equal, rewrite the example to force the spreadsheet to find the correct answer.
      a) 45 + 27/9
      b) 3*8-4
      c) 3 + 8*4
      d) 16+2*5-4*4
      e) (8+7)/3+2

2. Assume that a 15 is entered in A1 and a 12 is entered in B1. The cursor is positioned over C1 and the following formula is typed. Calculate the display in C1 as a result of entering the following, on the spreadsheet.

	A	B	C
1	15	12	

   a) 3*A1+B1
   b) 3*(A1+B1)
   c) 3+A1*B1
   d) 3+(A1*B1)

3. Assume the following data has entered on the spreadsheet. The formula 9*(A1-(B1/2)) is to be calculated in C1 and replicated from C2 to C5. Calculate the results that will appear in the C column.

	A	B	C
1	17	10	
2	26	6	
3	35	16	
4	50	0	
5	88	88	

4. Assume the following data has been entered on the spreadsheet. The formula (A1+(B1*C1))/D1 is to be calculated in E1 and replicated from E2 to E5. Calculate the results that will appear in the E column.

	A	B	C	D	E
1	4	6	8	2	
2	18	3	12	6	
3	18	9	19	6	
4	20	15	28	5	
5	35	14	16	7	

5. Assume the following data has been entered on the spreadsheet. The cursor is positioned over E1 and MIN(A1...D1) has been entered and replicated from E2 to E5. The cursor is then positioned over F1 and SUM(A1...D1)-E1 has been entered and replicated from F2 to F5. Calculate the results in the E and the F column.

	A	B	C	D	E	F
1	4	6	8	12		
2	18	3	12	16		
3	18	9	19	29		
4	20	15	28	25		
5	35	14	16	37		

HOMEWORK SOLUTIONS:

1A) a. 48
b. 8
c. 45+(27/9)

1B) a. 20
b. 20

1C) a. 35
b. 44
c. 3+(8*4)

1D) a. 10
b. 344
c. 16+(2*5)-(4*4)

1E) a. 7
b. 7

2a) 57 b) 81 c) 216 d) 183

3.

	A	B	C
1	17	10	108
2	26	6	207
3	35	16	243
4	50	0	450
5	88	88	396

4.

	A	B	C	D	E
1	4	6	8	2	26
2	18	3	12	6	9
3	18	9	19	9	21
4	20	15	28	5	88
5	35	14	16	7	37

5.

	A	B	C	D	E	F
1	4	6	8	12	4	26
2	18	3	12	16	3	46
3	18	9	19	29	9	66
4	20	15	28	25	15	73
5	35	14	16	37	14	88

CONSUMER MATHEMATICS

CALCULATORS

LESSON: 11L

AIM: How do we use the electronic spreadsheet to find the total price of an article after we consider discounts and sales tax?

PERFORMANCE OBJECTIVES: The student will be able to...

1. Enter data for sale items.
2. Use the titles command to fix labels.
3. Correct errors with:
   - a) The blank command.
   - b) The edit command.
4. Write formulas to calculate:
   - a) Discounted price.
   - b) Sales tax.
   - c) Sale price.
5. Round all answers to dollars and cents format with:
   - a) "$" option of the global command (VisiCalc).
   - b) Dollars option of the values format command (Appleworks).
6. Use replicate command to copy formulas relative to each item.
7. Insert a row and use the repeating label to produce a neat format.
8. Save and print the worksheet.

VOCABULARY: discount, discount rate, sales tax rate, formula, variable

MOTIVATION:

- Why do people shop at sales?
- Why do stores run end of season sales?
- What is a discount?

- Do stores ever advertise sales where selected items are discounted at different rates?
- Would it be possible to calculate different discounts using just one formula?

DEVELOPMENT:

1. Lead students to understand that people shop at sales to save money. When we say that a store discounts items we mean that the consumer will save a percentage of the original selling price. To know how much money will be saved and how much money an item will cost, it is necessary to know the original selling price of a sale item and the rate of discount that is being offered.

- Inform students that the power of the electronic spreadsheet can be used to simplify all the calculations that are needed to find the selling prices of various sale items. Although we do not suggest carrying a computer along with our shopping bags, there are many opportunities for us as consumers to take advantage of the power of the spreadsheet.
- We will make the assumption that the merchants and retail store employees have electronic spreadsheets available for calculating these prices. Sales that are advertised in newspapers, brochures and on radio or T.V. will give us the information we need to determine a sales price.

2. Pose problem: If a $20 item is subject to a 50% discount, what is the amount of the savings? The discounted price? Direct class discussion to develop rules for calculating discounts and discounted prices.

- To find the discount: Change the rate of discount from a percent to a decimal (fraction) and multiply by the original price. To find the New Price: Subtract the discount from the original price. Write these rules on the board.
- Pose problem: The Sports Palace is having an end of summer sale.

The following items are advertised with given discounts:

ITEM	PRICE	DISCOUNT
Fishing Pole	$150.00	20%
Running Suit	$ 29.95	25%
Water Skis	$180.00	20%
Picnic Set	$ 35.50	30%
Steel Thermos	$ 25.75	15%
White Socks	$ 2.98	25%
Boating Shoes	$ 17.99	10%

Find the sales price after calculating an eight and a quarter percent sales tax.

- Lead students to understand that a formula must be written so that they may convey their directions to the spreadsheet. Remind students that when using the spreadsheet we must first organize the way we enter the data and then we can refer to the data by its cell name. Agree to enter the item description in column A, the original price in column B and the rate of discount (the percents of discount changed to a decimal) in column C. Have students enter all data on the spreadsheet. (Titles and headings will be entered at a later time.)
- If students make errors while entering data they should be reminded of the different editing techniques that are used with the spreadsheet. At the beginning typing over incorrect data seems the fastest way to correct errors. Use the blank command to erase unwanted data from unused cells. The edit command is very useful when correcting formulas. Until the students become familiar with all the editing opions they should be reviewed somewhere in every lesson.

3. Direct student attention to writing the formulas that will yield the discounted price, the sales tax, and the sales price. Point to the rules, on the board, that were previously developed. Use these rules to develop a formula that can be used to find the discounted price. The first phrase tells us to change the percent to a decimal. We have already done this and our data is in C1. Next we are told to multiply this decimal by the original price, the data in B1. This yields the formula

C1*B1. We have now represented the amount of the discount. To find the discounted price the amount of the discount must be subtracted from the original price. This yields B1-C1*B1. Let us make it clear to the spreadsheet how this is to be calculated. Hopefully students will give you the following information. If not you will have to remind them.

a) Force a calculation of the discount first by using parentheses. B1-(C1*B1)

b) Explain that you are pointing a cell B1, (and not entering a label), by preceding the cell name with a plus sign. +B1-(C1*B1)

4. Ask students if they think the copy, or replicate command can be used to calculate the discounted price for all the items we entered. Lead them to understand that the "relative option" of the Copy Command provides for copying formulas with variables that can change from item to item. The variables in this formula are B1 and C1. Using this formula we find the discount on the Fishing Pole and +B1-(B1*C1) gives us the new price. When calculating the new price of the running suit the formula will automatically change to +B2-(B2*C2). To enter this formula on the spreadsheet position the cursor over D1 and enter +B1-(B1*C1), Return. 120 should appear in D1.

- Appleworks:

A1 (Open Apple-C) - To access the Copy Command.

A2 (Return, Return) - To copy within worksheet, a single entry.

A3 (↓, Period, ↓ to row 7, Return) - To indicate target range.

A4 (→, Return)

A5 (→, Return)

A6 (→, Return)

To choose relative change for each of the 3 variables that are listed in the formula.

- VisiCalc:

V1 (/R, Return) - To access the replicate command.

V2 (D2.D7, Return) - To choose Target Range.

V3 (R, R, R) - To select relative change for all three variables.

5. Elicit, now that the new price has been calculated the sales tax must be computed before we can determine the sales price. Elicit the current sales tax rate of eight and a quarter percent. Write this as both a percent and a decimal. Ask students if they feel it is necessary to enter this number for each sale item. Lead them to understand that since the number does not change the quickest way to calculate the sales tax is with a formula that contains only the one variable that represents the New Price. Develop the formula .0825*D1. Replicate this formula by positioning the cursor over E1. Enter +D1*.0825.

- Appleworks: Follow steps A1 through A4 in section 4. A5 and A6 are not necessary as relative change need only be chosen once since there is only one variable in the formula we are now using.
- VisiCalc: Follow steps V1 and V2 in section 4. Press R only once in step three as there is only one variable in the formula.

The sales tax column should now be complete.

6. Ask student what they expect to do with the sales tax, now that they have calculated it. Guide them to respond. The sales tax must be added to the discounted price to find the sales price. A third formula must be written to express this relationship. This formula will contain two variables. +D1+E1. Position the cursor F1. Enter +D1+E1. 129.90 will appear in F1. Position the cursor over F1 and prepare to replicate the current formula which contains two variables.

- Appleworks: Follow steps A1 through A5.
- VisiCalc: Follow V1, V2 and press R twice to indicate two relative changes for the two variables in the formula.

The final column is now filled with the sales price for each item. All the necessary numbers have been calculated and student attention should be directed toward formatting a neat and orderly spreadsheet. A suggested format follows.

```
                SPORTS PALACE END OF SUMMER SALE

ITEM               SELLING  DISCOUNT NEW        SALES     SALE
DESCRIPTION        PRICE    RATE     PRICE      TAX       PRICE
-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
Fishing Pole          150.00     0.20   120.00       9.90   129.90
Running Suit           29.95     0.25    22.46       1.85    24.32
Water Skis            180.00     0.20   144.00      11.88   155.88
Picnic Set             35.50     0.30    24.85       2.05    26.90
Steel Thermos          25.75     0.15    21.89       1.81    23.69
White Sport Socks       2.98     0.25     2.24       0.18     2.42
Boating Shoes          17.99     0.10    16.19       1.34    17.53
```

APPLICATIONS:

1. Insert two rows for column headings and a third row for the repeating label delineation.
- Appleworks: (Open Apple-I, Return, 3, Return)
- VisiCalc: (/IR, /IR, /IR)

  Enter the column headings, if time permits, and additional data is to be added to the worksheet, then the Titles Command can be used to fix the column heading in place at this time.

2. The delineator between the column headings and the sales data was formed by alternating the plus and minus sign. When two or more keys are used, the technique of depressing a key and holding it down until the line has been completed cannot be used. If this line interests you, fill cell A3 and replicate (copy) across the row.
- Appleworks: You will have to use the quote key to indicate that a label is being entered if you wish to begin with the minus or the plus sign. Remember Appleworks assumes that a value, or pointer, is being entered when it encounters either the plus or minus key. For a 9 character column enter ("-+-+-+-+-) in A3. If you look closely at the model you will see the adjacent minus signs at the end of every column. Position the cursor over A3 and enter (Open Apple-C, Return, Return, →, Period, → (to end of line), Return).
- VisiCalc: Use the Repeating Label Command and replicate

the display across the line (/-,-+, Return, /R, Return, →, Period, → (to end of line), Return).

3. Format the numerical data so that each entry appears with two fixed decimal places.

- Appleworks: This must be a global change where the value format is changed to Fixed (2) in the following manner. (Open Apple-V, Return, Return, 2, Return). If time permits an interesting exercise for the class is to see how Appleworks handles percent. If .20 is the entry and percent value format is chosen, 20% will appear on the sheet. (If 20 is the entry, 2000% will appear on the sheet.) You can reformat each entry in the percent column without changing any of our previous calculations. Appleworks will give the same answer to (150.00 * 20%) as it does to (150.00 * .20). Our rule of "change the percent to a decimal" is really not necessary when using Appleworks. What is vital to understand and should be stressed with the class is the manner in which we enter the 20%. If we attempt to enter a "2", a "0", and then a percent sign, we will hear tht unpleasant honk. We must enter ".20" and then reformat the cell with the percent option of the various value formats. Students will have to learn percent and decimal equivalents if they want to use Appleworks.
- VisiCalc: (/GF$) and all values will be displayed with two decimal places.

4. If you are pleased with the current appearance of the sheet it should be saved. Access the Save Command:

- Appleworks: (Open Apple-S) As soon as these keys are pressed the worksheet disappears, the message "carefully saving this file" with the file name in the upper lefthand corner appears and the drive is activated. When the disk drive stops the file is saved and we are returned to the worksheet.
- VisiCalc: (/SS) You are prompted to give the file a name so that it can be found on the catalog and retrieved at a future date. Name the file SALE and press Return.

5. Then final job will be to print the file. Consult introductory lesson 6 or the printer manual if your printer needs configuring. Position the cursor over cell A1.

- Appleworks: (Open Apple-P, Return, Return) If you wish to enter a date or choose to print more than one copy, these options can be entered at this time. The program is menu driven and if the printer has been configured properly, the printing will be automatic.
- VisiCalc: (/PP, -, ") enter the title, "SPORTS PALACE END OF SUMMER SALE", if you wish the compressed print the characters should be entered at this time. EQ would indicate escape Q. For a carriage return use R. To skip a line use R R, two carriage returns. Finally, enter the lower right coordinates and press Return.

SUMMARY:

1. What do we call the cell names when they are used in formulas?
2. What is the purpose of choosing relative change?
3. Where must the cursor be positioned when replicating a formula?
4. Will the formula G7*8 multiply the contents of cell G7 by 8? (no)...use either 8*G7 or +G7*8.
5. Assume a 70 appears in B5 and I wish to divide this entry by 100 and place the answer in C5. Where must my cursor be positioned? (C5) What formula will give me the desired results? (+B5/100)
6. How are rows inserted in the spreadsheet?
7. What is the effect of entering the quote " key before a data entry?

HOMEWORK:

1. A local clothing store offers the following items for sale.

ITEM	COST	DISCOUNT
Coat	$129	25%
Suit	$ 79	20%
Shirt	$ 15	15%
Slacks	$ 32	9%
Shoes	$ 28	6%

a) Assume the above data is entered on a spreadsheet. How would you enter the percent column?

b) Assume the cost is entered in column H form H6 to H10 and the rate of discount in column I from I6 to I10. Write a formula that can be replicated that will find the amount of the discount for the coat and place the results in J6. Describe where you would position the cursor when entering this formula.

c) Describe how you would provide for the discounted price to appear in K6.

d) Describe how you would calculate the amount of sales tax, and place it in L6, if sales tax is calculated at the rate of 7%.

e) Describe how you would calculate the sales price (after adding the tax) and place the answer in M6.

2. Prepare a neat orderly report, filling in all data, using the formulas that you wrote to calculate the sales price.

HOMEWORK SOLUTIONS:

1a) .25
.20
.15
.09
.06

1b) +H6*16 cursor positioned over J6.

1c) +H6-J6 cursor positioned over K6.

1d) +K6*.07 cursor positioned over L6.

1e) +K6+L6 cursor positioned over M6.

2.

ITEM	PRICE	RATE	DISCOUNT	NEW PRICE	TAX	SALE PRICE
Coat	129.00	0.25	32.25	96.75	6.77	103.52
Suit	79.00	0.20	15.80	63.20	4.42	67.62
Shirt	15.00	0.15	2.25	12.75	0.89	13.64
Slacks	32.00	0.09	2.88	29.12	2.04	31.16
Shoes	28.00	0.06	1.68	26.32	1.84	28.16

CONSUMER MATHEMATICS
EARNING A LIVING
LESSON: 6L

AIM: How can we use the electronic spreadsheet to calculate earnings based on hourly rates?

PERFORMANCE OBJECTIVES: The student will be able to...

1. Develop skill in entering data by creating a list of employee names and the number of hours worked.
2. Use the titles command to freeze the worker's names in place.
3. Write formulas that can convert minutes to hours.
4. Use the sum function to find total hours worked.
5. Use the replicate command to:
    - a) Replicate columns to copy hours worked in some cases.
    - b) Replicate salaries skipping over groups of data.
    - c) Replicate formulas across rows.
6. Write formulas that will project monthly and yearly earnings.
7. Use the storage command to save the worksheet named EARNINGS.

VOCABULARY: Projected earnings

MOTIVATION:

- If you had an after school job for which you were paid an hourly wage, would you keep a record of the hours you worked on an electronic spreadsheet?
- If you owned a company that published mailing lists, and you employed thirty students to enter the data and create these lists, would you find an electronic spreadsheet helpful for keeping employee records?

DEVELOPMENT:

1. Establish with the class the electronic spreadsheet is

used to great advantage when long involved calculations can be simplified. Have students enter the following data on the spreadsheet:

```
=====A==========B==========C==========D==========E==========F==========G
1  Employee    Monday   Tuesday Wednesday   Thursday     Friday
2-----------------------------------------------------------------------
3  J. SMITH         8         7         8          8          7
4  H. JONES         6         7         8          6          7
5  M. FRIEND        7         7         8          6          6
6  L. GARTH         8         7         8          7          7
7  B. Day           8         7         8          7          7
8  T. BROWN         9         7         8          9          6
9-----------------------------------------------------------------------
```

- Review the Titles Command with the class. When entering large groups of data it is helpful to fix the column labels and the employee names in place. Then we can move the cursor freely around the spreadsheet and the titles will never disappear from view. Position the cursor so that we can fix row 1 and column A.
- Appleworks: Hopefully someone will remember that the cursor should be positioned in cell B2. (Open Apple-T, →, →, Return)
- VisiCalc: Position cursor in A1. (/TB)

2. Review the built in functions with the class. These functions are accessed with the "@" key. Find the Sum of the B column. Position the cursor over B10. Enter @SUM(B3.B8), Return. A 46 will appear in B10. Leave the cursor over B10 and plan to replicate the SUM function across the row.

- Appleworks: (Open Apple-C, Return, Return, →, Period, →, (over to G10), Return)
- VisiCalc: (/R, Return, C10.G10, Return)

Row 10 now contains the following data.

```
    ===A======B======C======D======E======F======G===
10          46     44      48       43    39       0
```

- Position the cursor over G3 and type@SUM(B3.F3). Prepare to replicate the sum function down the column. Leave the cursor over G3.
- Appleworks: (Open Apple-C, Return, Return, ↓ , Period,↓ (down to G8), Return)
- VisiCalc: (/R, Return, G4.G8, Return)

Column G now contains the following data:

```
    ====G====
    3        38
    4        34
    5        34
    6        38
    7        37
    8        39
    9    ---------
   10       220
```

3. Let us assume that every worker on our sheet earned salary at a rate of $6.50 per hour. Add the Title "EARNINGS" to H1. When attempting this students will find that since they froze this section of the worksheet they can not enter H1 easily. The following procedure must be followed:

- Appleworks: The first line will appear to double. This image of the first line can be typed on. Simple move the up arrow until you hear the "honk" and see two "row 1's". Position the cursor over H1 in the lower "row 1" and type EARNINGS. As soon as you move the down arrow the title "EARNINGS" will appear in the top row as well. This Title is now fixed, along with the others in row one and column A. Appleworks refers to this procedure as "tucking under a row".
- VisiCalc: There is no way to enter this frozen region. You will have to unfix the title first with (/TN). The cursor can be anywhere when the Title Command is used to unfix a frozen region. Enter EARNINGS in H1 and then refix the titles. Position the cursor in A1 and enter (/TB).

A formula must be written to calculate each worker's earning. Elicit (hours * 6.50). Write this formula so that it can be used on the spreadsheet. Since the hours are placed in column G our first variable will be G3. We want our answer to appear in column H so our cursor must be positioned over H3: Enter (+G3*6.5, Return) 247 will appear in H3. Prepare to replicate this formula to find the salaries for the other employees. Since we would prefer to see our answer in the EARNINGS column in dollar and cents mode we can change our value format at this time. Then when we replicate the formula for the other employees the dollar and cents mode will be replicated as well.

- Appleworks: (Open Apple-L, Return, Return, →, Return, 2, Return) $247.00 now appears in H3.
- VisiCalc: (/F$) 247 has changed to 247.00
  Now we will do the replication. Since we are replicating a formula we position the cursor over the cell that contains the formula H3.
- Appleworks: (Open Apple-C, Return, Return, ↓, Period, ↓, (until H8), Return, →, Return, →, Return) all salaries appear properly formatted.
- VisiCalc: (/R, Return, H4.H8, Return, R, R)
  The earnings column should be completed.
- Sample suggested worksheet:

```
                      TOTAL EARNINGS BASED ON $6.50 PER HOUR

 EMPLOYEE   MONDAY  TUESDAY  WEDNESDAY  THURSDAY  FRIDAY  TOTAL HRS  EARNINGS
$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$
 J. SMITH        8        7          8         8       7         38    247.00
 H. JONES        6        7          8         6       7         34    221.00
M. FRIEND        7        7          8         6       6         34    221.00
 L. GARTH        8        7          8         7       7         38    247.00
   B. DAY        8        7          8         7       7         37    240.50
 T. BROWN        9        7          8         9       6         39    253.50
-----------------------------------------------------------------------------
                46       44         48        43      39        220   1430.00
```

4. Point out to students that the data entered up to this point has all been in complete hours. This is a very unrealistic picture. People work for parts of hours. They loose time for coming late or leaving early. The parts of hours that they work must be expressed in terms that the spreadsheet understands. Can I enter a 30 when I wish to convey 30 minutes? Elicit that the spreadsheet works in units. 8 units, 30 units, etc. We as thinking humans associate something with that unit, in this case, hours. We must always think only in a common unit when working with a spreadsheet. Develop the rules.
   a) If hours is our common unit all minutes must be entered as parts of hours by using the formula minutes/60.
   b) If minutes are to be used as our common unit all hours must be converted to minutes before they are entered on the spreadsheet by using the formula hours*60.
   c) Salaries are generally computed using hourly wages. This is almost universally accepted. (Has anyone ever heard of a salary per minute?) This class will agree to follow the first procedure. The rule should be placed on the board with the following addition. When time is reported in hours and minutes use the formula hours + (minutes/60).

   TEACHERS NOTE: IF the order of operation lesson (CALCULATORS LESSON 8L) has not been taught, some attention must be given to the use of the parenthesis in the above formula. For more details see that lesson.

- Pose the problem let us assume that Thursday's hours have been changed in the following way:

From	To	How to enter	How entry will look
8	7hrs 30min	7+(30/60)	7.5
6	6hrs 20min	6+(20/60)	6.333...
6	5hrs 40min	6+(40/60)	5.666...
7	6hrs 45min	6+(45/60)	6.75
7	7hrs 15min	7+(15/60)	7.25
9	8hrs 50min	8+(50/60)	8.8333...

APPLICATIONS:

1. Save the current worksheet and clear the page. Review the storage command with the class:

- Appleworks: (Open Apple-S) clear the page with the Delete Command. You will first have to clear TITLES. Position the cursor over A1 (Open Apple-T, Return, Open Apple-D, Return, ↓ (to highlight complete page), Return).
- VisiCalc: (/SS, (filename), Return) to clear the page (/CY).

2. Practice entering the following using the formula hours + (minutes/60).

   5 hrs. 5 minutes
   4 hrs. 12 minutes
   7 hrs. 24 minutes

   Continue in this manner until there are at least ten entries in the hours column. Enter three different hourly wages in the next column. For example: B1...B4 earn 5.75 per hour, B5...B7 earn 7.25 per hour and the remainder earn 9.80 per hour. Write a formula that can be replicated that will find the daily earnings. Position cursor over C1 and enter (+A1*B1, Return). Replicate this formula as outlined in step 2 of this lesson's development.

3. Write formulas that will project weekly, yearly and monthly earnings. Students may object at this point since hours worked vary from day to day. Explain that we do not have the time to enter all the data necessary to do an accurate projection. Argue that the different values entered will give us a fairly accurate idea what our yearly salary would be if we worked any one of the given daily hours. Use Column D for weekly earnings. (+C1*5) Replicate this formula for each worker. Use column E for yearly earnings. (+D1*52) Replicate this formula for each worker. Use column F for monthly earnings. (+E1/12) Replicate this formula for each worker.

4. Begin a new worksheet. Assume there are only six employees, use first names and enter only whole hours, no minutes. For example:

		A	B	C	D	E	F	G
1	Jim	8	7	8	7	7	6	
2	Mary	7	7	8	8	6	8	
3	Lola	7	7	7	6	8	9	
4	Ted	9	9	8	8	8	9	
5	Joan	9	9	8	8	8	9	
6	Scot	9	9	8	8	8	9	

Notice rows 4, 5, and 6 contain the same numerical data. Have students enter the numerical data in row 4 and replicate it in row 5 and 6. The procedure for replicating a row in several rows is: Position cursor over A4.

- Appleworks: (Open Apple-C, Return, →, →, →, →, →, Return, ↓ , Period, ↓ , Return)
- VisiCalc: (/R, A4.F4, Return, A5.A6, Return)

5. Have students use the built in sum function to find the total hour worked for each worker.

SUMMARY:

1. Who would be most likely to use an electronic spreadsheet for keeping hourly salary records?
2. When calculating hourly salary, how is 30 minutes entered?
3. When using dollar and cents format, what will "7.66666" become?
4. Is it necessary to compute each worker's salary individually when we use the spreadheet?
5. What if each worker earns a different salary and the number of hours worked varies as well? (If we are smart enough to write a correct formula the spreadsheet will do the job.)
6. What if a worker missed a day, will this effect the sum function? (The built in sum function totals all non-zero numbers, zeros will not effect a sum.)
7. What kind of data can be replicated on the spreadsheet? (Single entries, columns, rows, and formulas.)

8. What is the purpose of the Titles Command?

HOMEWORK:

1. Express the following times as hours and parts of hours.
   a) 5 hours 30 minutes
   b) 3 hours 15 minutes
   c) 7 hours 45 minutes
   d) 450 minutes
   e) 9 hours 10 minutes
   f) 8 hours 50 minutes
   g) 6 hours 20 minutes
2. Describe how the electronic spreadsheet would represent each of the above numbers if entered with the formula (hours + (minutes/60)), in both standard mode and dollar and cents mode?
3. Where would you position the cursor if you wished to fix Titles in the first three columns and the first four rows?
4. If Titles were fixed in row one describe how you would enter a heading in X1 for an additional column to be placed in column X?
5. Assume columns A through E contained a worker's daily hours for Monday through Friday respectively. Rows one through twenty are used to represent twenty different workers. Describe how you would use the spreadsheet to find the total hours worked for the week for each of the twenty workers?
6. Assume column T contains Total weekly hours. Column U contains hourly salary. Ron Ford is represented in row 6. Write formulas to find:
   a) Ron Ford's weekly earnings in column V.
   b) The projected yearly earning in column W.
   c) The projected monthly earnings in column X.

HOMEWORK SOLUTIONS:

1. a) Five and one half.
   b) Three and one quarter.

c) Seven and three quarters.
d) Seven and one half.
e) Nine and one sixth.
f) Eight and five sixths.
g) Six and one third.

2.

	Standard Mode	"$" Format or Fixed (2)
a)	5.5	5.50
b)	3.25	3.25
c)	7.75	7.75
d)	7.5	7.50
e)	9.1666...	9.17
f)	8.8333...	8.83
g)	6.3333...	6.33

Please note: If dollar value format is chosen with Appleworks all of the above entries in the second column will contain the Dollar Sign "$". The values will remain the same if 2 decimal places are chosen as well.

3. Appleworks: D5
VisiCalc: C4

4. Appleworks: Move the cursor with the up arrow until the first row doubles and you hear the "honk". Enter the title in X1, as soon as the down arrow is pressed this title will appear in both rows.
- VisiCalc: First remove the fixed titles with /TN enter the desired title in X1 and then refix row 1 by positioning the cursor in row 1 and entering /TH.

5. Position the cursor in F1. Enter@SUM(A1.E1), Return.
- Appleworks: (Open Apple-C, Return, Return,↓ , Period,↓ (to row 20), Return)
- VisiCalc: (/R, Return, F2.F20, Return, R, R)

6. a) Position cursor over V6:
Enter +T6*U6.
b) Position cursor over W6:
Enter +V6*52.
c) Position cursor over X6:
Enter +W6/12.

CONSUMER MATHEMATICS

EARNING A LIVING

LESSION: 10L

AIM: How can we use the electronic spreadsheet to calculate gross earnings involving overtime.

PERFORMANCE OBJECTIVES: The student will be able to...

1. Load the EARNINGS file previously saved.
2. Use the delete column option to eliminate previously calculated earnings.
3. Adjust hours worked to include totals over 40.
4. Write formulas to determine:
   a) The number of overtime hours worked.
   b) Total earnings based on regular time plus time and a half for overtime.
5. Explain what options will cause the spreadsheet to truncate, round values off, or display maximum precision.
6. Use the replicate command with relative change to complete the body of the worksheet.
7. Rename and save the file.
8. Delete any unwanted files from the disk.

VOCABULARY: delete columns, delete rows, delete files, truncate, precision

MOTIVATION:

What are some of the factors that effect a worker's gross earnings?

- What do we mean when we state "time and a half for overtime"?
- Pose Problem: Juanita Madison employs 100 workers. The hourly salary rates of all 100 workers are different. She is responsible for calculating the overtime salary rate, based on time and a half for overtime, for each of these 100 employees. If she uses a calculator to save

time, how may calculations must she plan to do? Is there a faster way to calculate overtime salary rate?

DEVELOPMENT:

1. Establish with the class that the use of a computer with an electronic spreadsheet will speed these 100 calculations. Agree to do this for 20 employees. Enter twenty names down column A, 20 different hourly salaries in column B. Begin with 4.80, increase the salary by .10 for several entries then by .25 for several entries, then by .40 etc., until the column is complete. Have the class write a formula that will determine the overtime salary for each employee. (+B1*1.5) Position the cursor over C1 and calculate the overtime earnings for the first employee by entering the formula and pressing Return. The cursor will remain in cell C1. Replicate this formula for the remaining 19 employees.
   - Appleworks: (Open Apple-C, Return, Return, ↓, Period, ↓ (to C20), Return, →, Return)
   - VisiCalc: (/R, Return, C2.C20, Return, R)

   The spreadsheet's ability to replicate and perform calculations with lightening speed is by far the most spectacular of its commands. Learning to effectively use a spreadsheet will depend on a student's ability to write formulas and use the replicate command.

2. Have students load the EARNINGS file saved at the previous lesson.
   - Appleworks: Press Escape to return from the spreadsheet to the main menu. Press Return twice, making sure that the correct disk drive is in effect. The catalog of the data disk appears on the video terminal. Use the arrows to move the cursor to the file named earnings and press Return.
   - VisiCalc: (/SL, EARNINGS, Return)

   We can rearrange this file to include hourly salary, overtime salary, and gross earnings. Have students delete the last three columns with the Delete Command. We plan to adjust the hours worked on Friday to include some totals over 40. We will also enter different hourly wages for each employee and include a column for overtime hours, overtime wages, and gross earnings. Prepare to delete the columns. Position the cursor anywhere in column F.

- Appleworks: (Open Apple-D, →, Return, →, →, Return)
- VisiCalc: (/DC, /DC, /DC)

Remind students that the original file is still the same as it was, saved safely on the disk under the name of EARNINGS. Tell students of your plan to rename this file before it is saved again. In the event that serious errors are made, incorrect rows or columns deleted, the file can be reloaded and the student given a second chance.

3. Spend a minute making sure that students understand the difference between deleting a file and deleting a row or column from the spreadsheet. If your computer is not controlled by the spreadsheet files are deleted from data disks by typing delete (filename) after accessing a catalog. While in the spreadsheet program:

- Appleworks: Choose option 5 of the main menu and then option 4 of the other activities menu. See section 10 of introductory lesson 6 for a more detailed description if needed.
- VisiCalc: Choose the delete option of the Storage Command "/SD" and then enter filename. You will have to respond "Y", for yes to assure VisiCalc you really want to delete the file.

4. Reenter the label Friday, the dividing line, and change the hours to 10, 9, 12, 10, 12, 11. Use column G to find the total hours worked. Have students review the built in Sum function. Position the cursor over G3 and type @SUM(B3.F3), Return. Leave the cursor over G3 and replicate the sum down the column.

- If time permits you may want to discuss the difference in calculating overtime on a daily basis as opposed to a weekly basis. For the purpose of our sample we will define overtime to be any hours in excess of 40 hours per week. Use column H to enter the regular hourly wage and column I to enter the overtime hourly wage. Use the procedure outlined in the first paragraph of this lessons development. Overtime hours may be placed in column J. Have student write a formula to find these hours (+G3-40). Before replicating this formula make sure all numbers are over 40. We notice that G4 is 36. Make sure that the replication starts in G5 and place a zero in J5. If this is not done then students will have to deal with negative numbers. Be careful!

Gross earnings may be placed in column K. The formula is long and complicated and the teacher may wish to break it up. Use your discretion here. A separate column could be planned for regular hours, regular earnings and overtime earnings. Gross salary could then be calculated as a simple sum. If one column, long formula is your choice then position the cursor over K3 and enter (G3-J3)*H3+(I3*J3). Notice the use of the parentheses. There is a two fold message here. First I am indicating a value is being entered, using parentheses instead of a plus sign and second I am informing the spreadsheet what calculations must be attended to first. This formula is also planned to be replicated down the entire column. In English, I multiply regular hours by regular wage and add the product of overtime hours and overtime hourly wage. Remember to choose the value format before replicating. We do not use global changes with this sheet as hours should not appear as dollars and cents. If you choose to use the long formula notice that there are five variables in this formula and relative change will have to be chosen five times.

Suggested addition:

```
======G======H======I======J======K===
3     41      5.00     7.50     1   207.50
4     36      6.25     9.38     0   225.00
5     40      7.60    11.40     0   304.00
6     42      8.50    12.75     2   365.00
7     42      9.30    13.95     2   399.90
8     44      9.75    14.62     4   448.50
```

5. Students may want to save this worksheet. Plan to save it with a new name. In this way the earnings file created at the last lesson will still be available. To change the name and save the file, follow the procedure:

- Appleworks: Access the change name command with Open Apple-N and type in the new name. "OVERTIME" will do nicely. Open Apple-S will activate the Save command. When the drive light goes off the file is saved.
- VisiCalc: Access the storage command with /SS, when prompted for a filename enter "OVERTIME", PRESS Return and observe the save procedure.

Students should be encouraged to view the catalog on the data disk to see that both the Earning and the Overtime files are listed.

- Appleworks: (Escape, Return, Return)
- VisiCalc: (/SL, → through catalog and read filenames on edit entry line.)

6. When the spreadsheet's value formats are used to round numbers what really happens to the numbers is that they are displayed in a rounded fashion. The exact number is still in the spreadsheet's memory and it is that exact number which is used for all calculations. Look at the last line of the OVERTIME file.

42   9.75   14.62   4   448.50

If we calculate 40(9.75) + 4(14.62) we find the correct answer is 448.48. This two point discrepancy is caused by the fact that (1.5*9.75) = 14.625 and it was this number that was used in the calculations. It might also be pointed out at this point that the reason 14.625 was rounded to 14.62, is that the number which precedes the 5(2) is even. In the fourth row, 9.375 has been rounded to 9.38. Here the number that precedes the 5(7) is odd. This manner of rounding off is only used with Appleworks. VisiCalc rounds 14.625 to 14.63 as well as 9.375 to 9.38. The final line of the overtime file for VisiCalc users would be:

42   9.75   14.63   4   448.50

and the result of calculating (40*9.75) + 4(14.63) would be 448.52, still a 2 point discrepancy. Both spreadsheets display numbers in a rounded off fashion whenever the user requests it. Even when columns are shortened the spreadsheet never truncates. Define this word for the class if using it for the first time. It is the act of chopping off digits from the right of a number. This occurred frequently in the early days when computers had only five spaces to store a number and the user tried to save a seven digit number. For example 23.3601 can be truncated to 23.360 or 23.36 or 23.3 or 23. or 23 etc. Our modern spreadsheets do not truncate. Numbers can be rounded off:

- Appleworks: By choosing Fixed decimal format in the manner described above. Be careful when changing column widths. In some cases Appleworks truncates numbers when columns are made too small.
- VisiCalc: To the nearest hundredth using the $ option of the Format Command. To the nearest Integer using the I option of the format command. To other accuracies by changing column widths. VisiCalc rarely truncates.

7. Numbers that have been previously rounded off may be returned to display maximum precision. Although this is not necessary for precise calculation as we have previously discussed it may be desirable for any number of reasons. It can be accomplished with:

- Appleworks: Use the appropriate option of the value format Layout Command.
- VisiCalc: Use the general option of the Format Command. (/FG)

APPLICATIONS:

1. Workers in the Makegood factory receive double their hourly wage if they work on Sunday. Write formulas and calculate their additional earnings.

```
   ---A------B------C----------D------
1  SUNDAY  HOURLY OVERTIME  ADDITIONAL
2  HOURS   WAGE   WAGE      EARNINGS
3       6   4.95
4       6   5.10
5       5   5.25
6     5.5   5.50
7     5.8   6.30
8    7.25   8.75
9       7   9.46
10   8.75   9.90
```

2. Use the above display with the following changes. Change Sunday hours to overtime hours. Calculate overtime wage based on "time and a half". Find additional earnings.

3. Load the Earnings file and delete the last four columns. Change the Thursday and Friday hours. Calculate Total hours, Regular hours, Overtime hours, Overtime wages, Regular earnings, Overtime earnings and Total earnings.

```
   ---E------F------G------H------I---
1  THURS  FRI
2  $$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$
3    12       14
4    13       14
5    10       10
6    10       11
7    11       11
8    13       12
```

SUMMARY:

1. What incentives do employers give their workers to work additional hours?
2. Is there a difference between deleting a file and deleting a row or column?
3. Is it possible to save the same file with different filenames? (yes) Explain?

4. Is it possible to save different files with the same filename? (no) Explain? (When saving two files with the same name the later file overwrites the earlier file.)

5. How is maximum precision returned to values that have been rounded off?

- Appleworks: (Choose appropriate.)
- VisiCalc: The general option of the Format Command.

6. How is dollar and cents format selected for only specific entries?

7. How are numbers rounded off to the nearest integer for all entries?

HOMEWORK:

1. Consider the following table:

```
   ---A------B------C-------D---------E-------F---------G------H------
1  TOTAL  HOURLY REGULAR OVERTIME  OVERTIME REGULAR  OVERTIME TOTAL
2  HOURS  WAGE   HOURS   HOURS     WAGES    EARNINGS EARNINGS EARNINGS
3####################################################################
4   45      4.80
5   47      5.05
6   47      5.25
7   48      5.70
8   48.5    6.25
9   50.5    6.60
10  52.25   6.75
11  52.6    7.10
12  53      7.65
```

a) Write a formula that can be used to find the overtime hours.

b) Write a formula that can be used to find the overtime wages.

c) Write a formula that can be used to find the regular earnings.

d) Write a formula that can be used to find the overtime earnings.

e) Write a formula that can be used to find the total earnings.

2. Describe how you would enter a 40 in every cell from D4 to D12.

3. Complete the table.

HOMEWORK SOLUTIONS:

1a) +A4-40
b) +B4*1.5
c) 40*B4
d) D4*E4
e) +F4+G4

2. Place a 40 in D4, press Return.
- Appleworks: (Open Apple-C, Return, Return, ↓ , Period, ↓ (to D12), Return)
- VisiCalc: (/R, Return, D5.D12, Return)

3.

```
   ---A------B------C-------D---------E-------F---------G------H------
1  TOTAL  HOURLY REGULAR OVERTIME  OVERTIME REGULAR  OVERTIME TOTAL
2  HOURS  WAGE   HOURS   HOURS     WAGES    EARNINGS EARNINGS EARNINGS
3#####################################################################
4   45      4.80   40       5      7.20       192.00   36.00    228.00
5   47      5.05   40       7      7.58       202.00   52.03    255.03
6   47      5.25   40       7      7.88       210.00   55.13    265.13
7   48      5.70   40       8      8.55       228.00   68.40    296.40
8   48.5    6.25   40       8.5    9.38       250.00   79.69    329.69
9   50.5    6.60   40      10.5    9.90       264.00  103.95    367.95
10  52.25   6.75   40      12.25  10.13       270.00  124.03    394.03
11  52.6    7.10   40      12.6   10.65       284.00  134.19    418.19
12  53      7.65   40      13     11.48       306.00  149.18    455.18
```

CONSUMER MATHEMATICS
EARNING A LIVING
LESSON: 12L

AIM: How can we use the electronic spreadsheet to calculate gross pay for employees paid both salary and commission?

PERFORMANCE OBJECTIVES: The student will be able to...

1. Write formulas that compute:
    a) Commission only.
    b) Total gross salary.
2. Project monthly and yearly salary.
3. Use the spreadsheet's ability to recalculate to see changes in salary when:
    a) Sales increase and decrease.
    b) Commission rates fluctuate.
4. Use the MAX() function on the total sales columns to determine leading salesman.
5. Use the arrange (Appleworks only) and print command to:
    a) Print lists in alphabetical order.
    b) Print list in order of sales. (Highest to lowest.)
6. Save and print the worksheet.

VOCABULARY: commission, rate of commission, recalculate, automatic recalculation

MOTIVATION:

The SELLMORE SALES COMPANY pays its salesmen a wage of $125.00 per week plus a commission of 6.25% of their total sales for that week. There are 18 salesmen employed. No two salesman have sold equal amounts. Our job, this period, will be to develop their salary schedule. I have a list of the salesmen's names and their total sales. What are some of the ways that we can complete this assignment? Predict the amount of time needed.

DEVELOPMENT:

1. Encourage students to suggest many ways to accomplish this task. Hopefully the electronic spreadsheet will be one of them. I am sure students will be very surprised at the speed at which this sheet is generated. The commission, wages and earnings column are all replicated. The only time consuming part is the entering of the 18 names and each associated total sales. The dollar and cents formatting is global and the labels and delineations can be added at a later time. If students feel that they can do this quicker with a calculator it might be wise to divide the class and have a race. There is no way that doing this by hand, or with calculator will win.

- The sheet must be planned in advance:
  - a) Names in column A.
  - b) Total sales in column B.
  - c) Commission in column C.
  - d) Wages in column D.
  - e) Earnings in column E.
- Formulas should be developed from rules:
  - a) To find commission, change the rate of commission to a decimal and multiply by the total sales.
    1. Rate of commission as a decimal = .0625
    2. Column C = .0625*Column B.
    3. Position cursor over C1 and enter (.0625*B1), Return.
  - b) Earnings are the total of the commission and the wages.
    1. Earnings = commission + wages.
    2. Column E = column C + column D.
    3. Position the cursor over E1 and enter C1+D1, Return.
- Rules and formulas should be placed on the board.

2. Have students enter names and total sales (see sheet below). When all have completed columns A and B, direct their attention to column D. Elicit that all wages are the same. We will make one entry and then replicate it. Enter 125 in D1 and press return. The cursor should remain over cell D1.

- Appleworks: (Open Apple-C, Return, Return, ↓, Period, ↓ (to D18), Return)
- VisiCalc: (/R, Return, D2.D18, Return)

  It is helpful to the students if they are reminded, at this point, they are not replicating a formula. There are no variables to consider and they need not bother with relative change.
- Have a student direct the class to find the commission by reading the first rule on the board. (Position cursor over C1 and enter (.0625*B1), Return). Cursor will remain over cell C1. Replicate this formula down column C. Use the same procedure as above with the addition of (one relative change). Now we are replicating a formula with one variable.
- Appleworks: (Open Apple-C, Return, Return, ↓, Period, ↓ (to D18), Return, ➤, Return)
- VisiCalc: (/R, Return, D2.D18, Return, R)

  One more column remains. To complete the earnings column have a student read the last rule on the board while the class enters it on the spreadsheet. (Position the cursor over E1 and enter (C1 + D1), Return.) Elicit that this formula must be replicated. Encourage students to tell you that there are two variables in the formula and relative change must be chosen for each of them. Thus the only change in the last replication procedure is the addition of a second relative change. The cursor should still be positioned over E1.
- Appleworks: (Open Apple-C, Return, Return, ↓, Period, ↓ (to D18), Return, ➤, Return, ➤, Return)
- VisiCalc: (/R, Return, D2.D18, Return, R, R)

3. The calculations should now be complete and the students convinced that the spreadsheet is faster than any other method. Insert two rows at the top. Enter the labels in row 1 and the delineator in row 2.

- Appleworks: Access the insert command with Open Apple-I, the line of percent signs can be added by depressing the percent key until the end of column E has been reached.
- VisiCalc: Position the cursor over row one and (/IR, /IR). Enter the labels in row 1. The percent signs are

entered in row 2 by positioning the cursor over A2 and entering (/-, %, Return, /R, Return, B2.E2, Return).

4. Sample completed worksheet:

```
            SELLMORE SALES COMPANY SALARY SCHEDULE

SALESMAN    TOTAL SALES  COMMISSION   WAGES    EARNINGS
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
T. BROWN        1200.00       75.00     125.00      200.00
R. CAPE         1350.00       84.38     125.00      209.38
B. DAY          1090.00       68.13     125.00      193.13
Y. FORD          980.00       61.25     125.00      186.25
J. GAMMS         880.00       55.00     125.00      180.00
N. JONES         775.00       48.44     125.00      173.44
R. KLEIN        1120.00       70.00     125.00      195.00
J. LEE          1030.00       64.38     125.00      189.38
J. LOPEZ         990.00       61.88     125.00      186.88
R. MANN          560.00       35.00     125.00      160.00
T. NEWEL         600.00       37.50     125.00      162.50
M. O'BRIEN       720.00       45.00     125.00      170.00
H. PAT           890.00       55.63     125.00      180.63
T. RO           1450.00       90.63     125.00      215.63
E. SHEU         1300.00       81.25     125.00      206.25
U. SINGH         950.00       59.38     125.00      184.38
V. WANG          575.00       35.94     125.00      160.94
R. YUNG          725.00       45.31     125.00      170.31
```

Save the worksheet with the storage command.

- Appleworks: Open Apple-S
- VisiCalc: /SS

Print the worksheet with the print command.

- Appleworks: Open Apple-P, Return, Return, Return, Return
- VisiCalc: /PP, E20

5. Do not clear the worksheet. Discuss with students the effect of changing the rate of commission on a salesman's earnings. Pose problems such as:

- Mr. Ro is offered a choice between a $10 weekly wage raise or a 1% increase in commission. Based on this week's total sales what choice will yield Mr. Ro the greater earnings increase? (Raise in commission.)

Show students how to find 1% of total sales in their heads. If they have trouble, create a new column and compare the two. Name the salesmen that would benefit from such and increase and those that would be better off with the $10 wage increase.

- Sellmore Sales reduced everyone's salary by $25 and increased their commission by 5%. Find the new earnings. This can be done by creating 3 new columns for the purpose of comparison. Students will also benefit by seeing how the spreadsheet recalculates. Change the numbers in column D by entering 100 in D3 and replicating it as we did in the previous example. Tell students to watch the earning column change as the wage column changes. Position the cursor over C3 and enter (.1125*B1), Return and replicate this formula as we replicated the original. As the commission column changes, watch the earnings column change.
- The Sellmore salesmen had a slow week last September due to an excessive heat wave. The result was that sales were reduced by 50% for each salesmen. Use the spreadsheet to show how their earnings were effected. (In the event that the sheets have been destroyed by previous calculations reload them from memory again.) Use column F to calculate (.5*B3), Return. Replicate and change the formula in C3 to read (.0625*F3). When this formula is replicated the total earnings column will change as well.

6. Ask students who the leading salesman was. They will give you the answer quickly. Ask them if they could have answered so quickly if there had been 180 salesmen, instead if 18. Ask them if they can suggest a way for the spreadsheet to find the leading salesman. Hopefully they will remember the built in MAX function that finds the highest number. Position the cursor over B21 and type MAX(B3.B20), Return. This formula can be used to find the maximum commission and maximum earnings.

7. If you are using the Appleworks spreadsheet you can make use of its arrange command and sort the salesmen in order

of sales. The procedure is to position the cursor in column B and access the arrange command with Open Apple-A. Use the arrow keys to highlight rows 3 through 20. Since we wish our leading salesmen to be first we choose the 9 to 0 option.

- Although VisiCalc will not sort you can use the move command to rearrange the rows. The MAX() function will direct you to the highest row, then simply move that row to the top and find the MAX() of the remaining rows, etc.

APPLICATIONS:

1. Reload the SELLMORE worksheet and delete all the columns except the names. Position the cursor in column B.

- Appleworks: Access the delete command with Open Apple-D, choose the columns option, highlight all columns except the first and press Return.
- VisiCalc: (/DC) four times.

```
TOTAL SALES
%%%%%%%%%%%
    1044.00
    1174.50
     948.30
     852.60
     765.60
     674.25
     974.40
     896.10
     861.30
     487.20
     522.00
     626.40
     774.30
    1261.50
    1131.00
     826.50
     500.25
     630.75
```

Enter the total sales figures at the left.
Use a commission of six and a quarter percent.
Use a common wage of $132.

Completed worksheet:

```
SALESMAN    TOTAL SALES COMMISSION  WAGES    EARNINGS
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
T. BROWN        1044.00       65.25     132.00      197.25
R. CAPE         1174.50       73.41     132.00      205.41
B. DAY           948.30       59.27     132.00      191.27
Y. FORD          852.60       53.29     132.00      185.29
J. GAMMS         765.60       47.85     132.00      179.85
N. JONES         674.25       42.14     132.00      174.14
R. KLEIN         974.40       60.90     132.00      192.90
J. LEE           896.10       56.01     132.00      188.01
J. LOPEZ         861.30       53.83     132.00      185.83
R. MANN          487.20       30.45     132.00      162.45
T. NEWEL         522.00       32.63     132.00      164.63
M. O'BRIEN       626.40       39.15     132.00      171.15
H. PAT           774.30       48.39     132.00      180.39
T. RO           1261.50       78.84     132.00      210.84
E. SHEU         1131.00       70.69     132.00      202.69
U. SINGH         826.50       51.66     132.00      183.66
V. WANG          500.25       31.27     132.00      163.27
R. YUNG          630.75       39.42     132.00      171.42
```

2. Project the yearly salary based on the current worksheet. You can use all sheets created this period, as time permits. Multiply the weekly earnings by 52.

- Project monthly salaries as well. Use the yearly salary and divide by 12.

3. How would a salesman that was offered a choice between a 2% raise in commission or a $20 wage increase determine the correct choice?

SUMMARY:

1. What is the advantage to an employer of paying workers a commission?
2. What advantage is there to a worker who collects commission?
3. If we make an accidental error and calculate commission of 3% instead of 4%, is it necessary to redo the entire spreadsheet?

4. Do salesmen achieve a greater increase in earnings by taking a raise in commission or a raise in wages?
5. When projecting monthly salaries, do we multiply the weekly salary by four? (No! 4X12 = 48 and there are 52 weeks in a year. Either multiply by four and a third or calculate the yearly salary first and divide by 12.)
6. What keystroke is used to access the built in functions?

HOMEWORK:

1. The Sellmore Sales Company was bought by the Newboss Sales Company. All salesmen were retained by the new company but a new policy governed salaries and commissions. The salesmen were paid at varying rates of commission and varying wages. The schedule is listed below.

NEWBOSS SALES COMPANY SALARY SCHEDULE

SALESMAN	TOTAL SALES	%OF COMMISSION	WAGES	COMMISSION	EARNINGS
T. BROWN	1251.27	0.06	125.00		
R. CAPE	1100.00	0.06	125.00		
B. DAY	1300.00	0.06	125.00		
Y. FORD	1256.00	0.06	125.00		
J. GAMMS	879.00	0.06	125.00		
N. JONES	976.00	0.06	125.00		
R. KLEIN	1108.76	.065	132.00		
J. LEE	1315.11	.065	132.00		
J. LOPEZ	699.05	.065	132.00		
R. MANN	578.00	.065	132.00		
T. NEWEL	989.89	0.07	150.00		
M. O'BRIEN	1090.00	0.07	150.00		
H. PAT	1168.90	0.07	150.00		
T. RO	1075.65	0.07	150.00		
E. SHEU	1112.09	0.07	150.00		
U. SINGH	770.00	0.08	175.00		
V. WANG	1090.00	0.08	175.00		
R. YUNG	1440.00	0.08	175.00		

a) Write a formula that will generate the commissions in column E.

b) When replicating this formula how many times must relative change be selected?

c) Write a formula that will generate the Earnings column.

d) Describe any differences in the procedure between the replication of the earnings formula and the replication of the commission formula.

2. Complete the table.

HOMEWORK SOLUTIONS:

1. a) +B3*C3
   b) 2
   c) +D3+E3
   d) none

2. NEWBOSS SALES COMPANY SALARY SCHEDULE

SALESMAN	TOTAL SALES	%OF COMMISSION	WAGES	COMMISSION	EARNINGS
T. BROWN	1251.27	0.06	125.00	75.08	200.08
R. CAPE	1100.00	0.06	125.00	66.00	191.00
B. DAY	1300.00	0.06	125.00	78.00	203.00
Y. FORD	1256.00	0.06	125.00	75.36	200.36
J. GAMMS	879.00	0.06	125.00	52.74	177.74
N. JONES	976.00	0.06	125.00	58.56	183.56
R. KLEIN	1108.76	.065	132.00	72.07	204.07
J. LEE	1315.11	.065	132.00	85.48	217.48
J. LOPEZ	699.05	.065	132.00	45.44	177.44
R. MANN	578.00	.065	132.00	37.57	169.57
T. NEWEL	989.89	0.07	150.00	69.29	219.29
M. O'BRIEN	1090.00	0.07	150.00	76.30	226.30
H. PAT	1168.90	0.07	150.00	81.82	231.82
T. RO	1075.65	0.07	150.00	75.30	225.30
E. SHEU	1112.09	0.07	150.00	77.85	227.85
U. SINGH	770.00	0.08	175.00	61.60	236.60
V. WANG	1090.00	0.08	175.00	87.20	262.20
R. YUNG	1440.00	0.08	175.00	115.20	290.20

CONSUMER MATHEMATICS
EARNING A LIVING
LESSON: 17L

AIM: How can we use the electronic spreadsheet to calculate net pay?

PERFORMANCE OBJECTIVES: The student will be able to...

1. Make use of the files previously written during this unit by retrieving them and calculating a realistic payroll, based on deductions.
2. Write a formula that will compute FICA based on 7.05% of earnings.
3. Use the insert a column command to enter the number of employee dependents.
4. Enter the withholding tax based on salary and dependents.
5. Compute net salary based on the deductions entered.
6. Use the replicate command to complete the payroll.
7. Use the sum function to find the total:
    a) Earnings.
    b) FICA.
    c) Withholding tax.
    d) Payroll.
8. Change the name of the file and save it with the storage command.

VOCABULARY: net earnings, FICA, withholding tax, payroll deductions

MOTIVATION:

The last time we used the spreadsheet we calculated earnings based on salary plus commission. All of the calculations we have been using the spreadsheet for, during this unit, have been concerned with different types of earnings. We've calculated earnings based on hourly wages and projected monthly and yearly earnings. What other factors must we consider before an employees net salary can be determined?

DEVELOPMENT:

1. Establish the reality of payroll deductions with the class. Elicit the various types of deductions and have students explain their purpose. Load the SELLMORE worksheet and plan to make this salary schedule a more realistic one. Add 4 columns, one each for federal, state and city tax and one for FICA.

- Appleworks: Load the SELLMORE file by choosing option 1 of the main menu. When the GET FILES menu is displayed check to see if the specified disk drive is correct. If it is then choose option 1 and the filenames of the files that are currently on the data disk will be displayed. Arrow the cursor down to the sellmore file and press return.
- VisiCalc: Access the load option of the Storage Command with (/SL, SELLMORE, RETURN).

  We wish to insert four columns between the wages and the earnings columns. Position the cursor anywhere in the earnings column:
- Appleworks: Access the Insert Command with Open Apple I. Choose the column option and press return. Enter the number 4 as we wish to insert 4 columns, and press return.
- VisiCalc: Access the Insert Command with (/IC), four times, to insert four columns.

  Columns E,F,G,H are now empty and the Earnings column has moved to Column I. Plan to enter FICA in Column E, and Federal, State, and City tax in columns F through H respectively.

2. Have the class write the formula that will calculate the FICA. We base the deduction on 7.05% of the employees earnings. Elicit that the percent must be changed to a decimal. Have students offer .0705*I3. Position the cursor over E3 and enter the formula. Press return and leave the cursor over the entry so that we may replicate this formula down the row. Copy the formula with:

- Appleworks: Open Apple-C, Return, Return, Move the arrows and use the period to highlight the beginning and end of the target range.
- VisiCalc: (/R, Return, E4.E20, Return, R)

If tables are available then this sheet can be made very accurate. If not they can be planned in advance using a rough approximation of 12% for federal, 4% for state and 1% for city. These charts can reflect 3 or 4 deductions or can be made as complicated as the level of the class will allow. The one offered here is based on 4 deductions. These numbers will have to be duplicated for the class or placed on the board. If the teacher thinks it it advisable to practice the replicate command, rather than just the entering of data then the percentage method can be used. After these three columns have been completed the salary can then be calculated. Choose column J to enter the Salary. Elicit the total deductions can be found by using the SUM function. In that case our formula will be +I3-@SUM(E3.H3) or use (I3-(E3+F3+G3+H3)). Position the cursor over J3, enter one of the above formulas and press return. Replicate the formula down the column as described above. Complete the worksheet by entering the appropriate column headings and extending the dividing line.

Suggested worksheet:

SALESMAN	SALES	COMMISSION	WAGES	FICA	FEDERAL TAX	STATE TAX	CITY TAX	EARNINGS	NET SALARY
T.BROWN	$1,200.00	$75.00	$125.00	$14.10	$24.00	$8.00	$2.00	$200.00	$151.90
R.CAPE	$1,350.00	$84.38	$125.00	$14.76	$25.12	$8.38	$2.09	$209.38	$159.02
B.DAY	$1,090.00	$68.12	$125.00	$13.62	$23.18	$7.73	$1.93	$193.12	$146.68
Y.FORD	$980.00	$61.25	$125.00	$13.13	$22.35	$7.45	$1.86	$186.25	$141.46
J.GAMMS	$880.00	$55.00	$125.00	$12.69	$21.60	$7.20	$1.80	$180.00	$136.71
N.JONES	$775.00	$48.44	$125.00	$12.23	$20.81	$6.94	$1.73	$173.44	$131.73
R.KLEIN	$1,120.00	$70.00	$125.00	$13.75	$23.40	$7.80	$1.95	$195.00	$148.10
J.LEE	$1,030.00	$64.38	$125.00	$13.35	$22.72	$7.58	$1.89	$189.38	$143.83
J.LOPEZ	$990.00	$61.88	$125.00	$13.17	$22.43	$7.48	$1.87	$186.88	$141.93
R.MANN	$560.00	$35.00	$125.00	$11.28	$19.20	$6.40	$1.60	$160.00	$121.52
T.NEWEL	$600.00	$37.50	$125.00	$11.46	$19.50	$6.50	$1.62	$162.50	$123.42
M.O'BRIEN	$720.00	$45.00	$125.00	$11.98	$20.40	$6.80	$1.70	$170.00	$129.12
H.PAT	$890.00	$55.62	$125.00	$12.73	$21.68	$7.23	$1.81	$180.62	$137.18
T.RO	$1,450.00	$90.62	$125.00	$15.20	$25.88	$8.62	$2.16	$215.62	$163.77
E.SHEU	$1,300.00	$81.25	$125.00	$14.54	$24.75	$8.25	$2.06	$206.25	$156.65
U.SINGH	$950.00	$59.38	$125.00	$13.00	$22.12	$7.38	$1.84	$184.38	$140.03
V.WANG	$575.00	$35.94	$125.00	$11.35	$19.31	$6.44	$1.61	$160.94	$122.23
R.YUNG	$725.00	$45.31	$125.00	$12.01	$20.44	$6.81	$1.70	$170.31	$129.35

3. By placing the Salary column next to the Earnings column the discrepancy in amounts can be readily seen. The column headings can be changed to gross pay and net pay to emphasize these terms. Have students find the vertical totals using the built in SUM Function. First find the sum of the total sales and then replicate this SUM across row 21. Position the cursor in B21, enter SUM(B3.B20), Return.

- Appleworks: Access the Copy Command with Open Apple-C. Press Return twice to choose within worksheet and highlight the entry we wish to copy. Use the right arrow to advance cursor to D21 and enter the period. Continue with the right arrow until the target range is highlighted, stopping at J21. Press Return to indicate the end of the target range and choose relative change twice, once for B3 and once for B20.
- VisiCalc: (/R, Return, D21.J21, Return, R, R)
  Agree to insert a line between the body of the sheet and the column totals. Position the cursor anywhere in row 21.
- Appleworks: Access the insert command with Open Apple-I, choose the row option and insert 1 row. Move the cursor to A21, enter the " keystroke to indicate a label is being entered. Press the minus key and hold it down until the row is filled through column J.
- VisiCalc: (/IR, /-, -, Return, /R, Return, D21.J21, Return)

4. Before this sheet is saved, ask students how they can save the sheet without destroying the SELLMORE sheet. Elicit that the filename of the spreadsheet must be changed. Name this sheet NETSAL and save it with the storage command:

- Appleworks: To change the name access the Name Change Command with Open Apple-N and enter NETSAL. Save the file with Open Apple-S.
- VisiCalc: (/SS, NETSAL, RETURN)

After the sheet has been saved, and while the display is still on the screen, ask students if they have made a hard copy of their sheet. The printed copy would be the hard copy. The copy before them on the video screen is a soft copy, it will disappear a soon as they clear their sheets. The copy on the disk is also called a soft copy. Unless they are very careful with their disk, this can disappear very quickly as well.

APPLICATIONS:

1. Enter the following data.

- Appleworks: The suggested worksheet uses a wide A column for employee names. Notice the sheet is sorted in ascending order of earnings. This is only a suggestion. First and last names can certainly be entered in separate columns. To achieve this format, column A will have to be widened. The procedure is to position the cursor anywhere in column A and access the column option of the layout command. Widen the column using the right arrow in conjunction with the Open Apple key. (Open Apple-L, ➤, ➤, Return, Return, ➤, ➤, ➤, Return, Open Apple-➤ (6 times), Return.)
- VisiCalc: If placed in separate windows column A can have a width different than the other columns. Most printers will not permit printing with the windows. I suggest this not be attempted at this point. Place the names in separate columns.

EMPLOYEE NAME	EARNINGS
Vera Friend	$177.23
Ellen Duba	$179.00
Sung Kim	$179.50
Yi Li	$180.80
Ted Hyte	$182.45
Bob Yung	$185.00
Jose Lopez	$186.00
Jes Field	$188.44
Terance Good	$189.89
Kim Yee	$190.38
John Spitz	$192.35
Fred Smith	$193.14
Randy Teli	$198.89
Park Soo	$199.57
Laura Shire	$200.00
Mary Brown	$201.50
Pam Moris	$205.67
Neil Moor	$210.56

2. Calculate the FICA column. Develop the formula +B3*.0705. Replicate this down column C.

3. Calculate the city tax column with the formula +B3*.0162. Replicate down column D.

4. Calculate the state tax with (B1*.0353). Replicate down Column E.

5. Calculate Federal tax with (B1*.0931). Replicate down column F.

6. Calculate total deductions with the sum formula. @SUM(B3.E3). Replicate down column G.

7. Calculate Net Salary with the formula +B3-G3.

8. Save and print the worksheet.

- Appleworks: (Open Apple-S, Open Apple-P, Return (4 times))
- VisiCalc: (/SS, NETSAL1, RETURN, /PP, -, H20, RETURN)

Suggested worksheet

File: NETSAL

EMPLOYEE NAME	EARNINGS	FICA	CITY TAX	STATE TAX	FEDERAL TAX	DEDUCTION TOTAL	NET SALARY
Vera Friend	$177.23	$12.49	$2.87	$6.26	$16.50	$38.12	$139.11
Ellen Duba	$179.00	$12.62	$2.90	$6.32	$16.66	$38.50	$140.50
Sung Kim	$179.50	$12.65	$2.91	$6.34	$16.71	$38.61	$140.89
Yi Li	$180.80	$12.75	$2.93	$6.38	$16.83	$38.89	$141.91
Ted Hyte	$182.45	$12.86	$2.96	$6.44	$16.99	$39.24	$143.21
Bob Yung	$185.00	$13.04	$3.00	$6.53	$17.22	$39.79	$145.21
Jose Lopez	$186.00	$13.11	$3.01	$6.57	$17.32	$40.01	$145.99
Jes Field	$188.44	$13.29	$3.05	$6.65	$17.54	$40.53	$147.91
Terance Good	$189.89	$13.39	$3.08	$6.70	$17.68	$40.85	$149.04
Kim Yee	$190.38	$13.42	$3.08	$6.72	$17.72	$40.95	$149.43
John Spitz	$192.35	$13.56	$3.12	$6.79	$17.91	$41.37	$150.98
Fred Smith	$193.14	$13.62	$3.13	$6.82	$17.98	$41.54	$151.60
Randy Teli	$198.89	$14.02	$3.22	$7.02	$18.52	$42.78	$156.11
Park Soo	$199.57	$14.07	$3.23	$7.04	$18.58	$42.93	$156.64
Laura Shire	$200.00	$14.10	$3.24	$7.06	$18.62	$43.02	$156.98
Mary Brown	$201.50	$14.21	$3.26	$7.11	$18.76	$43.34	$156.98
Pam Moris	$205.67	$14.50	$3.33	$7.26	$19.15	$44.24	$161.43
Neil Moor	$210.56	$14.84	$3.41	$7.43	$19.60	$45.29	$165.27

SUMMARY:

1. How are previously saved files loaded back to the spreadsheet?
2. Why do we change the name of files when we resave them?
3. What pattern do we generally use when changing file names?
4. Why do we choose to save our files on a disk and save our files a second time, by printing them?
5. What words do we use to characterize the disk copy and the printed copy?
6. If an employer enrolls his employees in a group medical plan that requires another payroll deduction, will the spreadsheet have to be redone?
   (No! Insert a column after the last deduction and before the Total deductions. Position the cursor over the first entry in the Total deductions column and edit the sum formula to include this additional column. Replicate the new sum formula down the Total deduction column.)

HOMEWORK:

1. Consider the following spreadsheet section.

```
====D========E==========F=========G=====
FICA    WITHHOLDING DISABILITY  TOTAL
            TAX               DEDUCTIONS
$10.19    $35.60       $0.72      $46.51
```

   a) Write a formula to calculate the total deductions.
   b) Assume a column is inserted while the cursor is positioned in column G. What happens to column G?
   c) This new column is for an additional payroll deduction. Employees have pledged .5% of their salary to aid famine victims. Write .5% a a decimal.
   d) Assume Total Earnings appears in column C, write a formula and describe how you would generate this new column. (G)
   e) How can the total deductions formula that you wrote in answer to part A, be edited to accommodate this change.

2. For the following, compute salary based on time and a half for hours worked in excess of 40, 7.05% FICA and no other deductions.

```
===A========B========C========D========E========F========G========H===
----------hours------------- hourly  overtime  EARNINGS FICA    SALARY
worked    regular  overtime  rate    rate
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
  52                         $4.95
  47                         $5.35
  46                         $5.75
  55                         $6.00
  50                         $7.10
```

a) Write a formula that will generate column C.
b) Describe how you would generate column B.
c) Write a formula that will generate column E.
d) Write a formula that will generate column F.
e) Write a formula that will generate column G.
f) Write a formula that will generate column H.
g) Complete the table.

3. Write the name of the command and the symbol that accesses that command, for each of the following:
a) Correct a formula.
b) Make a hard copy of the worksheet.
c) Copy the worksheet to a disk.
d) Eliminate an unneeded column.
e) Erase an unwanted file.
f) Change the column width for the entire sheet.

HOMEWORK SOLUTIONS:

1. a) SUM(D3.F3) or (D3+E3+F3)
b) The contents of column G is moved to column H. Column G is emptied. All formulas are adjusted and the spreadsheet recalculated.
c) .005

d) Position the cursor over G3. Enter +C3*.005, Replicate this formula down column G.

e) If using the built in sum function change F to G. If using the other formula simply add G3.

2.

```
===A========B========C=======D========E========F==========G========H===
----------hours------------- hourly  overtime  EARNINGS  FICA    SALARY
worked    regular   overtime  rate    rate
+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
  52        40        12      $4.95   $7.43     $287.10  $20.24  $266.86
  47        40         7      $5.35   $8.03     $270.18  $19.05  $251.13
  46        40         6      $5.75   $8.63     $281.75  $19.87  $261.89
  55        40        15      $6.00   $9.00     $375.00  $26.44  $348.56
  50        40        10      $7.10   $10.65    $390.50  $27.53  $362.97
```

a) +A4-40

b) enter 40 in B4 and replicate it down column B.

c) +D4*1.5

d) (40*D4)+(C4*E4)

e) (F4*.0705)

f (F4-G4)

3.

		COMMAND	APPLEWORKS	VISICALC
a)	Correct a formula	EDIT	OPEN APPLE-U	/E
b)	Hard copy	PRINT	OPEN APPLE-P	/PP
b)	Copy to a disk	STORAGE	OPEN APPLE-S	/SS
c)	Eliminate column	DELETE	OPEN APPLE-D	/DC
d)	Erase file	DELETE FILE	USE MENU	/SD
f)	Change the column width for the entire sheet.	STANDARD VALUES	OPEN APPLE-V	/GC

CONSUMER MATHEMATICS

MANAGING MONEY

LESSON: 5L1

AIM: Can the spreadsheet be used to assist us in computing sales tax?

PERFORMANCE OBJECTIVES: The student will be able to...

1. Develop skill in entering data on the spreadsheet by preparing a list of items and their price.
2. Use pointers and formulas to calculate sales tax and total cost for the first item on the spreadsheet.
3. Use the format option of the global command to convert all values to $ format.
4. Use the replicate command to calculate:
   a) Tax for each item.
   b) Total cost for each item.
5. Use the sum function to determine:
   a) Total daily tax.
   b) Total daily sales.
6. Practice formula writing by comparing C + .07*C = TC with 1.07*C = TC.

VOCABULARY: tax rate, sales tax, global, replicate

MOTIVATION:

Stephen and Jacquie decided to do some repair work on their Staten Island apartment. They hired Martin and agreed to pay him $75 a day. They purchased materials at a local home improvement center and spent $82.43.

- If Martin works three days how much will they have to pay him?
- Was any of the money that they spent at the home improvement center allocated to something other than their purchases?
- Are there any items that can be purchased in New York City without paying sales tax?

- What benefits do we, the citizens of New York City, gain from paying sales tax?

DEVELOPMENT:

1. First establish that most food and medicines are not taxed and that most non-health related services are taxed. Lead a brief discussion of how our taxes work for us. Offer students the following list of items recently purchased on a family shopping trip. Ask students how the electronic spreadsheet can be used to ease the burden of calculations. Hopefully they will tell you that the formula to compute the total price including the tax need only be entered once, and then replicated for all other items.

2. a) Enter the Titles, ITEM, PRICE, SALES TAX, TOTAL. Use the command that will center these titles.
   - Appleworks: (Open Apple-L, →, Return, Return, →, Return, →, →, Return)
   - VisiCalc: There is no center formatting for labels but if the entry is preceded by the " keystroke, spaces may be entered first. The following sequence of keys will center "PRICE" (" PRICE). There are two spaces after the quote keystroke and before the letter "P".

   b) Adjust the width of the ITEM column to 12 characters, remember default is 9.
   - Appleworks: (Open Apple-L, →, →, Return, Return, →, →, →, Return, Open Apple—→, Open Apple—→, Open Apple- →, Return)
     Have students notice that the centering of this entry has been preserved.
   - VisiCalc: Variable column width not available in most versions. Use two columns for entering the Item description, shorten titles, or widen all column widths to 12 in the following way. (/GFC12)

   c) Enter all data into the ITEM and the PRICE column.

3. Elicit the current tax rate of 8 1/4%. Have students change this tax rate to a decimal. Write a formula that will determine the amount of sales tax on the items listed below. Assume the ITEM PRICE is in column B. The formula will be (.0825*B2). Have students use the pointer method of entering this formula.

- Position the cursor over C2.
- Enter .0825* ←, Return.
- Read the formula on the cell indicator line. (.0825*B2) REPLICATE this formula to find the tax rate on all other items.
- Position the cursor over C2.
- Appleworks: (Open Apple-C, Return, Return, ↓, Period, ↓ to C10, Return, →, Return)
- VisiCalc: (/R, Return, ↓, Period, ↓ to C10, Return, R) This pointer method is offered for variety. The coordinates may be entered as well, use (/R, Return, C3.C10, Return, R).

4. Use the sum function to find the total price as well as review the built in functions. To find the total price for all items:

- Position the cursor in cell D2.
- Enter @SUM(B2.C2), Return.
- Follow procedure in section 3 to replicate the sum down the total column.

5. Insert a dividing line of equal signs between the body of the sheet and the Titles.

- Position the cursor in A2.
- Appleworks: (Open Apple-I, Return, 1, Return) will insert a blank row in row 2. Fill this row with equal signs by first entering the " keystroke to allow the entry of the = keystroke, and then depress the equal sign until the end of column D has been reached.
- VisiCalc: (/IR, /-, =, Return) to insert a row and fill A2 with the equal sign. Next replicate this repeating label with (/R, Return, →, Period, →, →, →, Return) using the pointer method.

6. Format the worksheet for printing.

   a) Conclude that entries are hard to read and crowded. Decide to format the entire sheet in dollar and cents mode. Elicit that this will be a global change since all the values on the sheet represent money.

   - Appleworks: (Open Apple-V, Return, →, Return, 2, Return)
   - VisiCalc: (/GF$)

     Have students comment on how much easier this is to read and understand.

   b) Choose Appropriate margins.

   - Appleworks:
   - This is a small worksheet. Add the column widths. 12 for the first column and 9 each for the next 3. A total of 39 characters. This leaves ample room for margins. We have an 80 character width and 10 characters per inch. Choose 1.5 inch margins at the right and left. Elicit this will be 15 characters each, a total of 69 characters to be printed. Access the printer option menu with:
   - Open Apple-O, LM, Return.

     The response is Inches?
   - Enter 1.5, Return.
   - The change on the menu is easily viewed.
   - Enter RM, Return, 1.5, Return.
   - Return to the spreadsheet with the Escape key.
   - VisiCalc: Margins are not available.

   c) Print the worksheet:

   - Appleworks: (Open Apple-P, Return, Return, Return, Return)
   - VisiCalc: (/PP, -, D11, Return) assuming that D11 is the lower right cell and we elect single spacing.

COMPLETED WORKSHEET

SALESTAX

ITEM	PRICE	SALES TAX	TOTAL
SUIT JACKET	$39.99	$3.30	$43.29
BLOUSE	$14.99	$1.24	$16.23
JEANS	$18.99	$1.57	$20.56
WORK SHOES	$44.99	$3.71	$48.70
DRESS SHOES	$21.99	$1.81	$23.80
BICYCLE	$79.99	$6.60	$86.59
CAR BATTERY	$54.99	$4.54	$59.53
CAR SHOCKS	$8.49	$.70	$9.19
RADIAL TIRES	$36.99	$3.05	$40.04

7. Have students save the SALESTAX worksheet.
- Appleworks: Open Apple-S
- VisiCalc: (/SS, SALESTAX, Return)

APPLICATIONS:

1. Ask students if sale tax rates vary across the country. Elicit that if these items were purchased in a city with a 4% tax rate there would be a substantial savings. Elicit that we only need change our formula and replicate it in the sales tax column to see the results. The automatic recalculation of the spreadsheet will do the work for us.
- Position the cursor in cell C3.
- Enter .04* ◂ Return.
- The tax will change to $1.60 and the Total to $41.59.
- Replicate the new formula down the column using the procedure described in section 3.

2. Suggest comparing this rate with a 2% sales tax rate. Use a new column for the purposes of comparison.
- Position the cursor in cell E3.
- Enter .02*, ◂, ◂,◂, Return.
- Replicate formula down column E.
- Find the NEW TOTAL with sum function. Remind class that the range of values in the sum is not adjacent therefore the comma is used instead of the period.

- Position the cursor in column F.
- Enter@Sum(B3,E3) and replicate this sum down the NEW TOTAL column.

3. Write a formula that will determine the savings between the 4% rate and the 2% rate. (D3 - F3) Use column G for the Savings column. Generate the column with the replicate command. Verify that the Sum of the data in column E and G is equal to the data in column C.

4. Enter column headings. Label column E "2%". Remind students that the % sign cannot be entered as it is neither a label or a value. We must precede our entry with the " keystroke.
- Appleworks: ("2%), center the entry.
- VisiCalc: (" 2%)

  Enter the NEW PRICE and SAVINGS Title.

  Extend the line of equal signs to complete the delineator.

5. Print the worksheet.
- Appleworks: Due to the expanded size, the margins will have to be changed to .5 inch each. Have students do this with the Open Apple-O command. Return to the spreadsheet with Escape and Print the sheet with Open Apple-P.
- VisiCalc: (/PP, -, G11, Return)

COMPLETED WORKSHEET

```
   ITEM         PRICE  SALES TAX   TOTAL  2% TAX   NEW TOTAL SAVINGS
=====================================================================
SUIT JACKET    $39.99    $1.60    $41.59    $.83    $40.82     $.77
BLOUSE         $14.99     $.60    $15.59    $.31    $15.30     $.29
JEANS          $18.99     $.76    $19.75    $.39    $19.38     $.36
WORK SHOES     $44.99    $1.80    $46.79    $.94    $45.93     $.86
DRESS SHOES    $21.99     $.88    $22.87    $.46    $22.45     $.42
BICYCLE        $79.99    $3.20    $83.19   $1.66    $81.65    $1.54
CAR BATTERY    $54.99    $2.20    $57.19   $1.14    $56.13    $1.06
CAR SHOCKS      $8.49     $.34     $8.83    $.18     $8.67     $.16
RADIAL TIRES   $36.99    $1.48    $38.47    $.77    $37.76     $.71
```

6. Calculate the Sales Tax charged for the computer supplies in the chart at the right. Use a 5% tax rate. Write two formulas.

a) .05*B3

b) 1.05*B3

Explain why the second formula eliminates the need for using the sum function. The sample sheet has been printed with a tax column. It is not necessary to find this column if using formula b. The sample was generated using formula a for the tax column and formula b for the TOTAL column.

REGULAR PRICE	SALE PRICE	SALES TAX	TOTAL
WORK STATION DESK	530.00	26.50	556.50
SECURITY ALARM	120.00	6.00	126.00
PRINTER STAND	50.00	2.50	52.50
SURGE PROTECTOR	102.50	5.13	107.63
LABELS 1000 PACK	8.75	0.44	9.19
DUST COVER	15.50	0.78	16.28
PRINTER PAPER	32.80	1.64	32.44
PRINTER RIBBONS	11.30	0.57	11.87
FLOPPY DISKS 5 1/4	21.25	1.06	22.31

SUMMARY:

1. How are tax rates used in calculations?
2. What is the current sales tax rate in New York City today?
3. How is sales tax calculated?
4. When using the spreadsheet to calculate the sales tax on twenty five items, how many examples must we do manually?
5. How do we inform the spreadsheet that we want a formula to be processed?
6. What name is given to the range of data that is to be copied? (The Source Range.)
7. What name is given to the range that has been cited for our copy procedure? (The Target Range.)
8. Is there a way of finding the sales price including the sales tax without first calculating the sales tax? (Multiple the price by 1.0825)

HOMEWORK:

1. Express the following tax rates as decimals.
   a) 5%
   b) 6.5%
   c) 7.25%
   d) 9.75%
   e) 0.4%

2. Assume column B has been filled with item costs. Write a formula that can be used to find the selling price which includes a sales tax rate of 7.5%. Place answers in column C.

3. a) Describe how you would use the spreadsheet to find the total amount of money spent on the family shopping trip developed in this lesson. Use the 8.25% tax rate.
   b) Find the Sum.

4. The Computer Store ran a sale on the items listed at the right. Complete this chart by
   a) Finding the sales tax, calculated at a rate of 5%,
   b) Find the Total price.

SALE ITEM	SALE PRICE
WORK STATION DESK	498
SECURITY ALARM	99
PRINTER STAND	45.95
SURGE PROTECTOR	89.95
LABELS 1000 PACK	6.95
DUST COVER	13.95
PRINTER PAPER	29.5
PRINTER RIBBONS	7.95
FLOPPY DISK 5 1/4	17.95

HOMEWORK SOLUTIONS:

1. a) .05 b) .065 c) .0725 d) .0975 e) .004

2. .Position the cursor in column C.
   .Enter 1.075*B3

3. a) .Position the cursor in D12.
   .Enter@SUM(D3.D11), Return.
   b) Sum = $347.93

4.

FIVE PERCENT TAX CHART

SALE ITEM	SALE PRICE	SALES TAX	TOTAL
WORK STATION DESK	498.00	24.90	522.90
SECURITY ALARM	99.00	4.95	103.95
PRINTER STAND	45.95	2.30	48.25
SURGE PROTECTOR	89.95	4.50	94.45
LABELS 1000 PACK	6.95	0.35	7.30
DUST COVER	13.95	0.70	14.65
PRINTER PAPER	29.50	1.48	30.98
PRINTER RIBBONS	7.95	0.40	8.35
FLOPPY DISK 5 1/4	17.95	0.90	18.85

CONSUMER MATHEMATICS

MANAGING MONEY

LESSON: 5L2

AIM: How can we use the spreadsheet to create and print a sales tax chart?

PERFORMANCE OBJECTIVES: The student will be able to...

1. Create a sales tax chart using:
    a) Pointers and formulas.
    b) Global $ format.
    c) Replicating formulas.
2. Neatly format the chart by:
    a) Inserting a row of labels.
    b) Right justifying each label.
    c) Drawing lines with the repeating character command.
3. Use the storage command to:
    a) Save the chart.
    b) Load the chart.
4. Use the options of the print command to create a hard copy:
    a) Single or double spaced.
    b) With a title, a date.
    c) With special characters for line spacing and print style.
5. Use the print command to print the sales tax chart.

VOCABULARY: increment, generate, hard copy

MOTIVATION:

What are some of the ways that people who work in retail stores calculate sales tax?

- How do YOU calculate sales tax as you shop?
- Is there an advantage to knowing the exact amount that you are about to spend?

DEVELOPMENT:

1. a) List some methods of calculating sales tax that are used by salespeople.
   - Computers with built in cash registers that determine the sales tax when a tax key is depressed.
   - Using an adding machine or a calculator.
   - Looking up the amount on a SALES TAX CHART.

   b) List some methods that shoppers can use.
   - Carry a pocket calculator with you and use it for calculating sales tax.
   - Get a rough estimate of the sales tax by multiplying by 8 or 9.
   - Get a even rougher estimate by multiplying by 10.
   - Make yourself a sales tax chart to carry in your wallet.

2. Elicit that the spreadsheet can be used to create this tax chart and the printer can produce the hard copy.

   a) Begin by generating a list of dollars from 10 to 100 in increments of 10.
   - . Label column A "Amount".
   - . Position the cursor in A2 and enter 10.
   - . Position the cursor in A3 and enter +A2+10, Return.
   - . Access the Copy command.
   - Appleworks: (Open Apple-C, Return, Return, ↓, Period, ↓ seven times, Return, →, Return)
   - VisiCalc: (/R, Return, A4.A10, Return, R)

   b) Continue list in increments of 100, through 1000. All should contain 100.
   - . Position the cursor in A12.
   - . Enter +A11+100, Return.
   - . Replicate through A20 choosing relative change once for the one variable in the formula.

   c) Elicit the current tax rate, the method of determining the amount of tax and develop the formula. Generate the tax column. Enter the label tax in B1.
   - . Position the cursor in B2.
   - . Enter +A2*.0825, Return.

- Replicate this formula through B20, with one relative change.

3. Elicit the need to improve the value format of the sheet. All numbers should be expressed in dollar and cents mode. They are difficult to read in this form and the exact amount of pennies is unclear. Since all values are to represent money this must be a global change. We are not interested in one or two columns or rows. We wish to reformat the entire sheet.

- Appleworks: (Open Apple-V, Return, →, Return, 2, Return)
- VisiCalc: (/GF$)
  - a) Student attention should be drawn to the way the cents column has been rounded off. If there is confusion toggle back and forth between the two formats. To return to the original sheet use:
  - Appleworks: (Open Apple-V, Return, →, →, →, →, Return)
  - VisiCalc: (/GFG)
  - b) When class is satisfied with the format of the sheet a few minutes should be spent practicing using the tax chart. Pose questions such as:
  - How much is the sales tax on $410.00?
  - To find the sales tax on four hundred ten dollars we look up the tax on both 400 dollars and 10 dollars and add the two amounts. $33 + .83 = $33.83
  - Find the sales tax on $1850. (82.50 + 66.00 + 4.13 = $152.63)
  - What is the sales tax on $666.00? (Elicit that the chart is not complete. The sales tax on $6.00 is not on the chart. In fact, the chart does not include any amounts less then $10.00.)

4. Develop a formula for dividing the dollar into equal increments:

   Pose questions such as:
   - If we had a 10% sales tax rate, what would the sales tax on one dollar be? ...on fifty cents?
   - How is the dollar divided when a 10% tax rate is in effect?

- Write a formula to establish this relationship. (1/10)
- Can we apply the principals just developed to divide the dollar into increments of eight and one quarter?
- Write a formula that we can use to generate the remainder of our tax table. (1/8.25)

5. We will attempt to make our tax chart as authentic as possible. We encounter the following circumstances.

- The first 10 cents are not taxed. Our first increment must be 10.
- The second increment must be six to adjust the discrepancy caused by making the first increment ten.
- Our third increment will finally be 1/8.25. Three numbers will have to be entered before our replication procedure can begin generating the remainder of the tax chart.

a) Plan the table before we begin. Place the lower limit of the tax range in column C, the upper limit in D and the sales tax in E. In the sample we have written the word amount so that it transverses two columns. Column C contains only the "A" which has been right justified. Column D contains "MOUNT" which we left justified. Column E is headed "TAX".

b) Generate the lower limit:

. Position the cursor in cell C2 and enter the three number that we agreed upon in section 3. (.01, , .11, , .18,)

. The cursor is now in C5. Enter +C4+(1/8.25), Return.

. Replicate down to row 84, thus generating column C.

c) Before generating column D the class should be given an opportunity to write the necessary formula. Pose questions such as:

- If row three begins at eleven, where must row two end?
- What relationship exists between the end of row one and the beginning of row two?
- Write a formula to express this relationship. (D2 = C3-1)

d) Generate the upper limit column:

- Position the cursor in cell D2.
- Enter +C3-.01, Return.
- Replicate through row 83.
- Enter 9.99 manually in D84.

e) Have a student explain why D84 could not be generated by the formula. (There is no data in C85.)

6. We are now ready to generate the tax column. Enter a zero for the first increment. The first ten cents is not taxed. Experiment to determine if tax is to be computed on the lower limit or the upper limit. Conclude that tax is to be computed on the upper limit.

- Position the cursor in E3.
- Enter +D3*.0825, Return.
- Replicate this down column D to D84.
- This should complete our tax chart and we are now ready to create our hard copy.

7. Because of the length of this sheet it is wise to print it with eight lines to the inch instead of the default six. Check your printer manual for the special characters that must be sent to he printer. Some printers use Escape B. Use single space and compressed pitch. Some printers use Escape Q for compressed pitch. This is generally 17 characters per inch. Remember the default is 10. To print the sheet:

- Appleworks: Access the printer option menu with Open Apple-O. Enter SS for Single spacing. This is Appleworks default spacing, it is wise to check that it hasn't been changed. Enter SC for the special character option. We want to enter both Escape B and Escape Q, or whatever your printer uses. Make sure you end the entry with the "^" keystroke. Return to the spreadsheet with the escape key. Access the Print Command with Open Apple-P and press return four times.
- VisiCalc: Access the Print command with "/PP" enter the "-" keystroke for single spacing, VisiCalc's default spacing is double. Enter the " keystroke to indicate Setup. Enter the Title NEW YORK CITY TAX CHART. Enter

^EB^EQ for escape B and escape Q if that is what your printer requires for 1/8" lines and compressed pitch. Enter one or two ^R for one or two carriage returns. If you do not do this your first line will begin where your title ends. That is not what you want. You want the title printed on a separate line and therefore need a carriage return. When all data has been entered press the return. Now you are being prompted for the lower right setup. After entering this cell name and pressing return the spreadsheet will be printed. The sample charts appear at the end of this lesson.

APPLICATIONS:

1. Save the sheet before you begin to rearrange it.
- Appleworks: (Open Apple-S)
- VisiCalc: (/SS, NYTAX, Return)

2. Plan to rearrange the way the titles are formatted. Right justify all titles and insert a delineator between the titles and the body of the sheet. This affords us an opportunity to review the delete command, the insert command, the layout command and the repeating label command.

a) Delete the current row of titles. Position the cursor in row one.
- Appleworks: (Open Apple-D, Return, Return)
- VisiCalc: (/DR)

b) Insert two rows, one for titles and the other for the delineator. Position the cursor in row one.
- Appleworks: (Open Apple-I, Return, 2, Return)
- VisiCalc: (/IR, /IR)

c) Enter the titles, Amount and Tax. Leave cursor in row one and prepare to right justify these titles.
- Appleworks: (Open Apple-L, →, Return, Return, →, Return, →, Return)
- VisiCalc: (/GFR)

The upper limit column has no heading in this format. If class wishes titles can be changed. FROM and TWO are two possibilities.

d) Use the second row to draw the repeating label. Position cursor in A2. Elect to use a line of percent signs.

- Appleworks: Use the " keystroke to enter the percent key. Hold it down until the delineator is complete.
- VisiCalc: (/-, %, Return, /R, Return, B2.E2, Return)

3. Save the sheet under a new name and reload the original tax chart.

- Appleworks: (Open Apple-N, Newchart, Return, Open Apple-S) Enter escape to return to the main menu. Choose the "Add files" option and when a catalog of the data on the disk in the current drive is displayed, select the Taxchart file saved previously.
- VisiCalc: (/SS, NEWCHART, Return, /CY, /SL, NYTAX, Return)

4. Some students may object to the length of this sheet. Our original aim was to have something to carry in our wallets. Prepare to print a wider and shorter sheet. Divide the eighty three entries among three columns. This yields approximately 28 entries per column. Have students suggest different ways of reformatting this sheet. We hope the copy command will be one of the suggestions. This is an excellent way to reformat this sheet and should be used if the teacher wishes. We are going to suggest recreating the sheet as we did in the lesson. We feel that students, working on their own, repeating the process they just witnessed is an excellent reinforcement of the techniques presented in this lesson.

5. Plan the sheet with the class. Do not change columns ABCDE. Enter $3.32 in F2 and $6.71 in I2. Elicit the formulas F2+(1/8.25) and I2+(1/8.25). Each formula must be replicated down to row 29. The formulas used to generate rows G and J are +F3-.01 and +I3-.01. These formulas are to be replicated down to row 28. Remind students that the entries in row 29 are to be put in manually. The tax columns H and K are generated by .0825*G2 and .0825*J2. Permit students to complete the sheet on their own. Remind them to enter the column

headings. Print the sheet as we did in section 7.

SUMMARY:

1. How are lists of data generated by the spreadsheet?
2. Where must the cursor be positioned when replicating a formula?
3. What key separates the starting and ending point of the target range?
4. What is the name given to the cell or cells that we wish to copy?
5. How many times do we have to choose relative change or no change?
6. If we want a label to occupy more than one column can we choose to begin an entry with blank spaces? (Only if we use the " keystroke first.)
7. What does the spreadsheet do with the cents when we choose the dollar option for the value format? (It rounds it off.)
8. How can we return the worksheet to the original format? (The appropriate option of the Layout command or "/GFG"?)

HOMEWORK:

1. Use the tax chart to determine the sales tax on:
   a) $ 282.10
   b) $ 999.90
   c) $1677.00
2. Round the following numbers to the nearest cent.
   a) $255.5555
   b) $109.0099
   c) $346.6606
   d) $981.999
3. We wish to create a 7% tax chart.
   a) Write a formula that can be used to generate the lower limit column.

b) Write a formula that can be used to generate the upper limit column.

c) Write a formula that can be used to generate the tax column.

4. Make a 7% Tax Chart through $3.50.

HOMEWORK SOLUTIONS:

1. a) $ 23.27
   b) $ 82.50
   c) $138.26

2. a) $255.56
   b) $109.01
   c) $346.66
   d) $982.00

3. a) +A2 + (1/7)
   b) +A3 - .01
   c) +A2 * .07

4.

AMOUNT		TAX
$.01	$.10	$0.00
$.11	$.14	$.01
$.15	$.28	$.02
$.29	$.43	$.03
$.44	$.57	$.04
$.58	$.71	$.05
$.72	$.85	$.06
$.86	$1.00	$.07
$1.01	$1.14	$.08
$1.15	$1.28	$.09
$1.29	$1.43	$.10
$1.44	$1.57	$.11
$1.58	$1.71	$.12
$1.72	$1.85	$.13
$1.86	$2.00	$.14
$2.01	$2.14	$.15
$2.15	$2.28	$.16
$2.29	$2.43	$.17
$2.44	$2.57	$.18
$2.58	$2.85	$.19
$3.01	$3.14	$.22
$3.15	$3.28	$.23
$3.29	$3.43	$.24
$3.44	$3.55	$.25

NYC TAX CHART

AMOUNT		TAX	AMOUNT		TAX	AMOUNT		TAX
$.01	$.10	$0.00	$3.32	$3.43	$.28	$6.71	$6.82	$.56
$.11	$.16	$.01	$3.44	$3.55	$.29	$6.83	$6.94	$.57
$.17	$.28	$.02	$3.56	$3.67	$.30	$6.95	$7.06	$.58
$.29	$.40	$.03	$3.68	$3.79	$.31	$7.07	$7.18	$.59
$.41	$.52	$.04	$3.80	$3.92	$.32	$7.19	$7.31	$.60
$.53	$.64	$.05	$3.93	$4.04	$.33	$7.32	$7.43	$.61
$.65	$.77	$.06	$4.05	$4.16	$.34	$7.44	$7.55	$.62
$.78	$.89	$.07	$4.17	$4.28	$.35	$7.56	$7.67	$.63
$.90	$1.01	$.08	$4.29	$4.40	$.36	$7.68	$7.79	$.64
$1.02	$1.13	$.09	$4.41	$4.52	$.37	$7.80	$7.91	$.65
$1.14	$1.25	$.10	$4.53	$4.64	$.38	$7.92	$8.03	$.66
$1.26	$1.37	$.11	$4.65	$4.76	$.39	$8.04	$8.15	$.67
$1.38	$1.49	$.12	$4.77	$4.89	$.40	$8.16	$8.28	$.68
$1.50	$1.61	$.13	$4.90	$5.01	$.41	$8.29	$8.40	$.69
$1.62	$1.74	$.14	$5.02	$5.13	$.42	$8.41	$8.52	$.70
$1.75	$1.86	$.15	$5.14	$5.25	$.43	$8.53	$8.64	$.71
$1.87	$1.98	$.16	$5.26	$5.37	$.44	$8.65	$8.76	$.72
$1.99	$2.10	$.17	$5.38	$5.49	$.45	$8.77	$8.88	$.73
$2.11	$2.22	$.18	$5.50	$5.61	$.46	$8.89	$9.00	$.74
$2.23	$2.34	$.19	$5.62	$5.73	$.47	$9.01	$9.12	$.75
$2.35	$2.46	$.20	$5.74	$5.86	$.48	$9.13	$9.25	$.76
$2.47	$2.58	$.21	$5.87	$5.98	$.49	$9.26	$9.37	$.77
$2.59	$2.71	$.22	$5.99	$6.10	$.50	$9.38	$9.49	$.78
$2.72	$2.83	$.23	$6.11	$6.22	$.51	$9.50	$9.61	$.79
$2.84	$2.95	$.24	$6.23	$6.34	$.52	$9.62	$9.73	$.80
$2.96	$3.07	$.25	$6.35	$6.46	$.53	$9.74	$9.85	$.81
$3.08	$3.19	$.26	$6.47	$6.58	$.54	$9.86	$9.97	$.82
$3.20	$3.31	$.27	$6.59	$6.70	$.55	$9.98	$10.00	$.83

NEW YORK CITY SALES TAX CHART

AMOUNT	TAX
10.00	0.83
20.00	1.65
30.00	2.48
40.00	3.30
50.00	4.13
60.00	4.95
70.00	5.78
80.00	6.60
90.00	7.43
100.00	8.25
200.00	16.25
300.00	24.75
400.00	33.00
500.00	41.25
600.00	49.50
700.00	57.75
800.00	66.00
900.00	74.25
1000.00	82.50

AMOUNT		TAX
0.01	0.10	0.00
0.11	0.17	0.01
0.18	0.29	0.02
0.30	0.42	0.03
0.43	0.54	0.04
0.55	0.66	0.05
0.67	0.78	0.06
0.79	0.90	0.07
0.91	1.03	0.08
1.04	1.15	0.09
1.16	1.27	0.10
1.28	1.39	0.11
1.40	1.51	0.12
1.52	1.63	0.13
1.64	1.75	0.14
1.76	1.87	0.15
1.88	2.00	0.16
2.01	2.12	0.17
2.13	2.24	0.18
2.25	2.36	0.19
2.37	2.48	0.20
2.49	2.60	0.21
2.61	2.72	0.22
2.73	2.84	0.23
2.85	2.97	0.24
2.98	3.09	0.25
3.10	3.21	0.26
3.22	3.33	0.27
3.34	3.45	0.28
3.46	3.57	0.29
3.58	3.69	0.30
3.70	3.81	0.31
3.82	3.93	0.32
3.95	4.06	0.33
4.07	4.18	0.34
4.19	4.30	0.35
4.31	4.42	0.36
4.43	4.54	0.37
4.55	4.66	0.38
4.67	4.78	0.39

4.79	4.90	0.40
4.91	5.03	0.41
5.04	5.15	0.42
5.16	5.27	0.43
5.28	5.39	0.44
5.40	5.51	0.45
5.52	5.63	0.46
5.65	5.75	0.47
5.77	5.88	0.48
5.89	6.00	0.49
6.01	6.12	0.50
6.13	6.24	0.51
6.25	6.36	0.52
6.37	6.48	0.53
6.49	6.60	0.54
6.61	6.72	0.55
6.73	6.84	0.56
6.85	6.96	0.57
6.97	7.08	0.58
7.09	7.21	0.59
7.22	7.33	0.60
7.34	7.45	0.61
7.46	7.57	0.62
7.58	7.69	0.63
7.70	7.81	0.64
7.82	7.93	0.65
7.94	8.05	0.66
8.06	8.18	0.67
8.19	8.30	0.68
8.31	8.42	0.69
8.43	8.54	0.70
8.55	8.66	0.71
8.67	8.78	0.72
8.79	8.90	0.73
8.91	9.02	0.74
9.03	9.15	0.75
9.16	9.27	0.76
9.28	9.39	0.77
9.40	9.51	0.78
9.52	9.63	0.79
9.64	9.75	0.80
9.76	9.87	0.81

CONSUMER MATHEMATICS

MANAGING MONEY

LESSON: 14L

AIM: How do we use the spreadsheet to calculate simple interest?

PERFORMANCE OBJECTIVES: The student will be able to...

1. Generate a list of principle amounts using the replicate command on a column.
2. Review the simple interest formula by entering it on the spreadsheet using a variable to represent the principle.
3. Use the formula A3+(A3*.07*1) to create a chart depicting 5 years of 7% simple interest on the principles previously generated.
4. Replicate this formula across the row with the No change option.
5. Understand why the parentheses are necessary in the above formula.
6. Change the time period by editing the formula with the edit command for 2...5 years.
7. Replicate formulas down columns with Relative change to complete the body of the table.
8. Use the storage command to save the worksheet.

VOCABULARY: principle, amount, interest, edit

MOTIVATION:

Peter acquired an after school job that yielded him $60 a week. After subtracting $27 for expenses he found he could save $33 a week. He decided to buy himself a stereo recorder that cost $150. How many weeks will he have to wait to accumulate enough money to pay for his recorder?

DEVELOPMENT:

1. Students should be encourage to calculate the sales tax ($12.38) and then divide $162.38 by 33. Peter will have

to save for five weeks. During that time many factors can change Peter's plan. One problem might be that the money, if not kept in a safe place, could get lost or stolen. Where would the safest place be for Peter to put his money?

a) Elicit that a Savings Bank is not only safe, it is the sensible place because the money will earn interest as well.

- Tell students to assume that banks are paying 7% simple interest.

  Ask students how they would find the amount that their principle would grow to in four or five years. We hope they will remember the formula they learned.

b) Pose the following problem. Find the amount that $100 will grow to at 7% simple interest for each of the next 5 years. At the same time, calculate the amount that each multiple of 100 through $2000 will grow to at the same interest rate, for the same time periods.

- Elicit that for a problem of that magnitude, the spreadsheet will have to be used or the calculations will take longer than the period of time allocated for the lesson.

c) Ask students if there is any advantage in creating a table that contains all these amounts? Elicit that they will be able to plan future spending patterns based on monies earned by bank interest.

2. Enter the spreadsheet and prepare to generate a list of the various principles. We are interested in generating multiplies of 100 through 2000.

- Position the cursor in A1, enter 100.
  . Arrow down to cell A2.
  . Enter 100 + A1, Return.
  . Replicate to A20.
- Appleworks: (Open Apple-C, Return, Return,↓ Period, to A20, Return, →, Return)
- VisiCalc: (/R, Return, A3.A20, Return, R)

This completes our principle column.

3. To generate the YEAR-1 column we need a formula that will yield the interest at the rate of 7% for one year and add it to the principle.

   Elicit +A1 + (A1*.07*1).
   - Position the cursor in B1.
   - Enter the above formula and press return.
   - Replicate as described in section 2 to B20.

   This completes the YEAR-1 column.

4. Have class elect to insert the titles at this point. Enter the label Principle and the "G" column heading, "YEAR-1". Replicate this label across row one to column F. Position the cursor over B1, where the label YEAR-1 is situated.

- Appleworks: (Open Apple-C, Return, Return, →, Period, →, →, →, Return)
- VisiCalc: (/R, Return, C1.F1, Return)

  The label YEAR-1 appears five times and we shall edit it to change the number. Position the cursor over C1 and access the edit command.
- Appleworks: (Open Apple-U, Open Apple-E) we have also entered change mode. Direct student attention to the block cursor on the bottom lines. This has replaced the insert cursor which looks like a minus sign.
- VisiCalc: (/E)

  The label YEAR-1 appears on the edit entry line. We wish to change the 1 to a 2.
- Appleworks: Position the cursor over the 1 and enter a 2. The arrows move the cursor while on this line. This change can also be made in insert mode (with the small dask like cursor). Follow the directions for editing in VisiCalc below, instead of using the escape key to erase, use the delete key.
- VisiCalc: Move the cursor with the right arrow to one space past the one. By pressing escape the "1" will be erased. Enter the 2. In a similar manner change each year until the titles have all been corrected. This technique is extremely useful for editing formulas as we shall see later on in the lesson.

5. The repeating label command can be used to separate the column headings from the body of the table. Position the cursor in A2.

- Appleworks: Depress any letter, hold it down until column F has been filled. If a key other than a letter is used make sure you precede it with the " keystroke.
- VisiCalc: (/-,- Return, /R, Return, B2.F2, Return)

This completes the dividing line.

6. We are now ready to complete the sheet. The four columns that remain can be generated by the same formula that generated column B if we change the final number, the one that represents the year. Remind students of the formula they used to generate column B +A1+(A1*.07*1). Elicit that the variable has now changed to A3 since we inserted the two rows. Move the cursor to B3 and point out the formula. Position the cursor over B3. Replicate it across the row as we did earlier with the label YEAR-1 (see section 3). This time there are variables in the formula and we will be asked if we want relative change or no change for every occurrence of the variable. Simple interest is computed on the original principle only. We want NO CHANGE for both occurrences of A3. The final number, the one that represents the number of years must be changed in each column. Position the cursor in C3. Access the edit command. The formula +A3+(A3*.07*1) appears on the edit entry line. Change the 1 to 2 as described in section 3. Replicate this formula down column C. Continue in this manner, editing and replicating the formulas +A3+(A3*.07*3), +A3+(A3*.07*4), +A3+(A3*.07*5), down columns D, E, and F respectively. This procedure should complete the five columns.

7. The final step would be to format the values to dollar and cents mode. Elicit that this is a global change and the command to use will be:

- Appleworks: (Open Apple-V, Return, →, Return, 2, Return)
- VisiCalc: (/GF$)

This completes the sheet. It is now ready for saving.

- Appleworks: (Open Apple-S)
- VisiCalc: (/SS, SIMPLE7, Return)

COMPLETED TABLE:

7% SIMPLE INTEREST

PRINCIPAL	YEAR-1	YEAR-2	YEAR-3	YEAR-4	YEAR-5
100	107	114	121	128	135
200	214	228	242	256	270
300	321	342	363	384	405
400	428	456	484	512	540
500	535	570	605	640	675
600	642	684	726	768	810
700	749	798	847	896	945
800	856	912	968	1024	1080
900	963	1026	1089	1152	1215
1000	1070	1140	1210	1280	1350
1100	1177	1254	1331	1408	1485
1200	1284	1368	1452	1536	1620
1300	1391	1482	1573	1664	1755
1400	1498	1596	1694	1792	1890
1500	1605	1710	1815	1920	2025
1600	1712	1824	1936	2048	2160

APPLICATIONS:

1. Use the table just generated to answer questions similar to the ones listed below.
   - What will $1100 be worth after four years at 7% simple interest?
   - How long must $900 remain in the bank at 7% simple interest before its value reaches $1200?
2. The formula that we used to find the value of our bank deposit after a given number of years contained a set of parentheses. Could this formula have been written without the parentheses. Elicit that the spreadsheet does not give any operation precedence. If we eliminated the parentheses and did not change the order the

spreadsheet would add A3 to itself. That sum would then be multiplied by .07 and the product multiplied by the number of years. The numbers can be rearranged. +A3*.07*3+A3 will yield the same results as the +A3+(A3*.07*3).

3. Create a simple interest table illustrating three years of six and one half percent interest on principles ranging from $25 to $250. Generate the principles with the formula +A1+25 and the amounts with +A1*.0625*time+A1. Use the technique of editing the formula to change the year. Include column heading and dividing lines.

   Completed Worksheet:

PRINCIPAL	YEAR-1	YEAR-2	YEAR-3
$25.00	$26.62	$28.25	$29.88
$50.00	$53.25	$56.50	$59.75
$75.00	$79.88	$84.75	$89.62
$100.00	$106.50	$113.00	$119.50
$125.00	$133.12	$141.25	$149.38
$150.00	$159.75	$169.50	$179.25
$175.00	$186.38	$197.75	$209.12
$200.00	$213.00	$226.00	$239.00
$225.00	$239.62	$254.25	$268.88
$250.00	$266.25	$282.50	$298.75

SUMMARY:

1. Are we always asked to choose either No change or Relative change when using the Replicate command? (No, only when we are replicating a formula that contains a variable.)
2. How does the principle differ from the amount?
3. Sometimes a bank will credit interest quarterly, four times a year. If the annual rate is 8%, what is the quarterly rate?

4. Appleworks: When is it wiser to access the standard values command rather than the layout command?
5. VisiCalc: When is it wiser to access the Global command rather than the layout command?
6. What will appear on the spreadsheet when 8.50 is entered? (8.5)
7. If the entry in cell R4 is 4.6547 and we choose to reformat with the dollar option, how will the display in R4 change?
8. Where do we position the cursor if we wish to add 25 to cell F5 and place the answer in cell G5.
9. What command causes the contents of the cell where the cursor is currently located to appear on the edit/entry line? (The edit command.)

HOMEWORK:

1. Express as a fraction the part of a year represented by the following:
    - a) 3 months
    - b) 4 months
    - c) 6 months
    - d) 8 months
    - e) 9 months
2. Express the following percents as decimals.
    - a) 3 1/2%
    - b) 4%
    - c) 5 1/4%
    - d) 6%
    - e) 6 3/4%
3. Assume a Principle has been entered in T7. Write a formula that can be used to find:
    - a) The simple interest on the principle at the rate of 8% for a period of 6 years.
    - b) The amount that the principle has reached after 2 years at the rate of 4% simple interest.

   c) The simple interest on the principle at the rate of 10% after 3 months.

4. Describe how the following columns can be generated.
   a) The years beginning with 1980 and ending with 2000 to be generated in row one.
   b) A list of Principals from $2000 to $5000 at $50 intervals to be generated in column A.
   c) The amount that the principles in exercise 4b have reached after 9 years at 7.3% interest, generated in column B.

5. Tim borrowed $700 from Chris. He agreed to pay 5% annual simple interest for a period of two years.
   a) What is the total interest that Tim will have to pay Chris?
   b) If he agrees to return the money in four equal payments how much will each payment be?

HOMEWORK SOLUTIONS:

1. a) 1/4 b) 1/3 c) 1/2 d) 2/3 e) 3/4

2. a) .035 b) .04 c) .0525 d) .06 e) .0675

3. a) +T7*.08*6
   b) +T7*.04*2+T7
   c) +T7*.1*.25

4. a) Enter 1980 in A1, Position cursor in B1, enter 1 + A1, Return, Replicate through U1 with one relative change.
   b) Enter 2000 in A1, Position cursor in A2, enter 50 +A1, Return, Replicate through A7.
   c) Position cursor in B1, Enter +A1*.073*9+A1, Return, Replicate down column B to B7.

5. a) $70 interest.
   b) $192.50 each payment.

CONSUMER MATHEMATICS

MANAGING MONEY

LESSON: 16L

AIM: How can we use our simple interest table to create a compound interest one.

PERFORMANCE OBJECTIVES: The student will be able to...

1. Retrieve the worksheet on simple interest.
2. Position the cursor so that the simple interest formula appears on the coordinate line.
3. Use the edit command to change formula to +A3*((1+.07) 1).
4. Review the techniques of:
    - a) Replicating across row with No change.
    - b) Edit each formula to reflect the correct amount of years.
    - c) Replicate down columns to change all data.
5. Use the global format $ command to eliminate all but two decimal places.
6. Understand that the global format $ command takes precedence over the global format justification and manually right justify all titles.
7. Use the print command to print a neatly formatted worksheet:
    - a) VisiCalc: With a title.
    - b) Appleworks: With variable column widths.

VOCABULARY: referenced values

MOTIVATION:

Is there a way of converting the 7% simple interest table that we created at our last session to a 7% COMPOUND interest table?

DEVELOPMENT:

1. Elicit that the simple interest table was generated by a formula. The formula we used was i = prt. Since the default recalculation of the spreadsheet is automatic, when a formula is changed and the change replicated, the spreadsheet will automatically recalculate all values that were generated by the original formula. Recalculation also takes place when values referenced by that formula are changed. We use the expression "values referenced" to indicate the cells that a formula uses as variables. We calculated the amount for the first YEAR of simple interest by using the formula A3+(A3*.07*1). Here our formula referenced the cell A3. If we change the data in cell A3 then our formulas will generate different numbers. In this lesson we will discuss two ways of changing data on the spreadsheet.
   a) By changing the formula.
   b) By changing the data referenced by the formula.

2. Ask students how compound interest is calculated. Elicit that one way is with the formula they learned in a previous lesson.

   A = P(1+i)^n

   Since the Simple interest table was generated by formulas, changing the formula could transform the table into a compound interest one. This lesson, instead of beginning with a blank worksheet, load the simple interest table into the worksheet.

- Appleworks: Choose the add files option of the main menu and then the current disk drive option to see a menu of what is on the data disk. This is accomplished by pressing return twice as both options are first on their respective menus. To select the SIMPLE7 file, move cursor until SIMPLE7 is highlighted and press return. The file will be loaded into the spreadsheet. Before the changes are entered change the name of the file. Call it COMPOUND7. (Open Apple-N) will access the change filename option. (Open Apple-E) will put the cursor into change mode. Position the cursor over the S in SIMPLE7 and enter the change.

- VisiCalc: (/SL, SIMPLE7, Return)

3. Prepare to change the formulas. The principle column will remain the same.
   a) The first change we will make is with the formula that generated the YEAR-1...YEAR-5 columns. Position the cursor over B3. The formula that appears on the EDIT/ENTRY line is the one for simple interest. Change that to the one for compound interest.
   +A3*(1+.07) 1
   . Enter the above formula, press Return.
   . Replicate this formula across row 3 to column F with no change.
   . Edit this formula in column C by changing the last number (years) to 2.
   . In a similar manner make changes for 3, 4, and 5 years. Use the same technique as outlined in the previous lesson, 14L. Row 3 should be complete.

4. We are going to generate these columns all at once. This time the replicate command will have B3...F3 as the source. If the teacher thinks this is too complicated for the level of the class then each column can be generated individually as we did in the previous lesson.
   . Position the cursor over B3.

- Appleworks: (Open Apple-C, Return, →, →, →, →, Return, ↓, Period, ↓ to row 27, Return, →, Return) Column B will be generated. The formula will change and the cursor will be positioned over the A3. You will have to press Relative change once for every column to be generated. The program will stop automatically before each column is generated until the body of the sheet has been completed.
- VisiCalc: /R, →, →, →, →, Return, B4.B27, Return, R) Column B will be generated. The formula will change and the cursor will be positioned over the A3. You will have to press Relative change once for every column to be generated. The program will stop automatically before each column is generated until the body of the sheet has been completed.

There should be no need to format this page with the dollar option as all cells were formatted for the Simple Interest page. If entries are not properly formatted then do so at this time.

5. Check to see that the column headings are properly formatted. We want them right justified so that they are neatly positioned over each column. In global formatting, dollar option takes precedence over right and left justifying. It may be necessary to reformat the labels if global changes have been made on the sheet. Save the worksheet:

- Appleworks: Open Apple-S.
- VisiCalc: (/SS, COMP7, RETURN)

Suggested Worksheet:

7% INTEREST COMPOUNDED YEARLY

PRINCIPAL	YEAR-1	YEAR-2	YEAR-3	YEAR-4	YEAR-5
100.00	107.00	114.49	122.50	131.08	140.26
200.00	214.00	228.98	245.01	262.16	280.51
300.00	321.00	343.47	367.51	393.24	420.77
400.00	428.00	457.96	490.02	524.32	561.02
500.00	535.00	572.45	612.52	655.40	701.28
600.00	642.00	686.94	735.03	786.48	841.53
700.00	749.00	801.43	857.53	917.56	981.79
800.00	856.00	915.92	980.03	1048.64	1122.04
900.00	963.00	1030.41	1102.54	1179.72	1262.30
1000.00	1070.00	1144.90	1225.04	1310.80	1402.55
1100.00	1177.00	1259.39	1347.55	1441.88	1542.81
1200.00	1284.00	1373.88	1470.05	1572.96	1683.06
1300.00	1391.00	1488.37	1592.56	1704.03	1823.32
1400.00	1498.00	1602.86	1715.06	1835.11	1963.57
1500.00	1605.00	1717.35	1837.56	1966.19	2103.83
1600.00	1712.00	1831.84	1960.07	2097.27	2244.08
1700.00	1819.00	1946.33	2082.57	2228.35	2384.34
1800.00	1926.00	2060.82	2205.08	2359.43	2524.59
1900.00	2033.00	2175.31	2327.58	2490.51	2664.85

2000.00	2140.00	2289.80	2450.09	2621.59	2805.10
2100.00	2247.00	2404.29	2572.59	2752.67	2945.36
2200.00	2354.00	2518.78	2695.09	2883.75	3085.61
2300.00	2461.00	2633.27	2817.60	3014.83	3225.87
2400.00	2568.00	2747.76	2940.10	3145.91	3366.12
2500.00	2675.00	2862.25	3062.61	3276.99	3506.38

6. Print the worksheet. Because of the size use compressed pitch.

- Appleworks: (Open Apple-O, SC, Return, ESCAPE Q- Escape). We make the assumption that the ESCAPE Q sequence is the correct one for your printer. This MUST be checked with the printer manual. The final escape returns the display to the spreadsheet for printing. (Open Apple-P, Return, Return, Return, Return)
- VisiCalc: (/PP, -, ", 7% INTEREST COMPOUNDED YEARLY EQ, ^R,^R, RETURN, F27, RETURN). This sequence assumes that escape Q is your printer's code for compressed pitch. This must be checked with the manual. The R indicates a carriage return to VisiCalc. As soon as you press return the Title will be printed, the program then waits for the user to input the lower right coordinates of F27.

APPLICATIONS:

1. Our plan is to create a compound interest table like the one used by professionals. This table will show the amount that $1 is worth at various interest rate for periods of 1 to 12 years.
   a) We begin by changing the principle column from (100 to 2500) to (1 to 12). Position the cursor over A3 and enter the value 1. As soon as 1 is entered the sheet begins the automatic recalculation. This takes a few seconds and we hope the class will watch as the spreadsheet program changes its answers based on the new principle in A3. When the recalculating stops, move the cursor to A4 and enter 1+A3, Return. A 2 appears in A4. Replicate this formula down column A to A15, choosing one relative change. The recalculation will take several seconds.

b) We will not be using the rows from 16 to 27. It would be wise to delete them at this time as they slow the program's ability to calculate and recalculate. Do this with the Delete Command. Position the cursor in row 16.

- Appleworks: (Open Apple-D, Return, ↓ to row 27, Return)
- VisiCalc: (/DR twelve times)

c) Rename the first column heading YEARS. Change the Year column headings to 5%, 5 1/2%, 6%, 6 1/2%, ... 8%. Position the cursor over B3, enter the formula 1*(1+.05)^A3, Return. Replicate this formula across row 3 to column H with No change. Edit each formula to reflect the correct rate of percent as indicated on the column heading.

- Appleworks: Use insert mode and follow direction for VisiCalc with one change. Substitute the Delete key for the Escape key.
- VisiCalc: Position the cursor over C3 and access the edit command. The formula that appears on the EDIT/ENTRY LINE is 1(1+.05)^A3. Position the cursor over the) and enter 5. The formula changes to 1(1+.055)^A3. Move the cursor to D3. The formula is still 1(1+.05)^A3 as we replicated it with No change. This time position the cursor over the) and enter ESCAPE, 6. This will erase the 5 and replace it with a 6. Continue in this manner until all formulas have been edited.

d) We will now replicate these formulas down the columns all at once as we did in the development. Position the cursor in B3.

- Appleworks: (Open Apple-C, Return, → six times, Return, ↓, Period, ↓ ten times, Return, →, Return). As each column is completed the program will wait for the user to press Relative change.
- VisiCalc: (/R, → six times, Return, B4.B15, Return, R). As each column is completed the program will wait for the user to press Relative change.

The body of the sheet should be completed.

e) In this sheet we are interested in maximum precision. If the sheet is formatted for dollar and cents, change it.

- Appleworks: (Open Apple-V, Return, →, →, →, →, Return)
- VisiCalc: (/GFG)

NOTE If we do calculations on the sheet then the answer will be based on the precise number, not the rounded off one that is displayed. The purpose of creating this table is for use when the computer is not available. It is therefore necessary to display maximum precision or our calculations will be incorrect.

f) Left justify the values in column A for clarity. Position the cursor over A3.

- VisiCalc: (/FL), this will have to be done for all twelve values in column A.
- Appleworks: Values cannot be right justified in Appleworks. We can change column widths however and simulate this justification. The plan is to change the width of columns A and B to 4 characters each. Leave column B empty and the values will appear to be left justified in column A. We begin by inserting a column between columns A and B. Position the cursor anywhere in column B. (Open Apple-I, Return, 1, Return), will insert a column in the desired position. Next access the Layout command to change the width of the two columns. Position the cursor anywhere in column A (Open Apple-L, →, →, Return, →, Return, →, →, →, Return, Open Apple- ← five times, Return). If the cursor is moved throughout the sheet the changes in the formulas, due to the insertion of the column, can be viewed. The sheet is now ready for printing.

2. If time permits a second sheet similar to the one just created can be made for the values from 8% to 10%.

COMPLETED SHEETS:

AMOUNT OF $1 AT COMPOUND INTEREST

YEARS	5%	5 1/2%	6%	6 1/2%	7%	7 1/2%	8%
CICICICICICICICICICICICICICICICICICICICICICICICICICICICICICICICICI							
1	1.050000	1.055000	1.060000	1.065	1.070000	1.075000	1.080000
2	1.102500	1.113025	1.123600	1.134225	1.1449	1.155625	1.1664
3	1.157625	1.174241	1.191016	1.207950	1.225043	1.242297	1.259712
4	1.215506	1.238825	1.262477	1.286466	1.310796	1.335469	1.360489
5	1.276282	1.306960	1,338226	1.370087	1.402552	1.435629	1.469328
6	1.340096	1.378843	1.418519	1.459142	1.500730	1.543302	1.586874
7	1.407100	1.454679	1.503630	1.553987	1.605781	1.659049	1.713824
8	1.477455	1.534687	1.593848	1.654996	1.718186	1.783478	1.850930
9	1.551328	1.619094	1.689479	1.762570	1.838459	1.917239	1.999005
10	1.628895	1.708144	1.790848	1.877137	1.967151	2.061032	2.258925
11	1.710339	1.802092	1.898299	1.999151	2.104852	2.215609	2.331639
12	1.795856	1.901207	2.012196	2.129096	2.252192	2.381780	2.518170

YEARS	8 1/2%	9%	9 1/2%	10%
CICICICICICICICICICICICICICICICICICICICIC				
1	1.08500	1.09000	1.09500	1.10000
2	1.17722	1.18810	1.19903	1.21000
3	1.27729	1.29503	1.31293	1.33100
4	1.38586	1.41158	1.43766	1.46410
5	1.50366	1.53862	1.57424	1.61051
6	1.63147	1.67710	1.72379	1.77156
7	1.77014	1.82804	1.88755	1.94872
8	1.92060	1.99256	2.06687	2.14359
9	2.08386	2.17189	2.26322	2.35795
10	2.26098	2.36736	2.47823	2.59374
11	2.45317	2.50843	2.71366	2.85312
12	2.66169	2.81266	2.97146	3.13843

SUMMARY:

1. What is the default calculation of the spreadsheet? (Automatic)
2. What keystroke forces the computer to recalculate?
3. When a formula is changed, how many cells will the data change? (Just one.)
4. How many cells will change if the data in one cell is changed? (As many as depend on that cell, it could be every one on the sheet.)
5. When formulas are changed, is it necessary to re-replicate them? (Yes)
6. How long does it take money to double that is in a 6% savings account that is compounded yearly?
7. When we created the table depicting $1 compounded at different rates of interest, why didn't we round our numbers, or use dollar format?
8. Is it possible to left justify values? (Yes for VisiCalc. No for Appleworks.)
9. Describe how column widths are changed.

HOMEWORK:

1. a) Find the amount that $800 is worth when compounded yearly at 7% interest for four years.
   b) Find the amount that $800 is worth after 7% simple interest is calculated for four years.
   c) What type of interest results in the greater yield, and how much more interest is earned?
2. Use the table we created in class to find:
   a) The amount that $100 is worth when compounded yearly at 8 1/2% for one year, two years ... twelve years.
   b) The amount that $200 is worth when compounded yearly at 9% for one year, two years ... twelve years.
   c) The amount that $300 is worth when compounded yearly at 9 1/2% for one year, two years ... twelve years.

d) The amount that $400 is worth when compounded yearly at 10% for one year, two years ... twelve years.

HOMEWORK SOLUTIONS:

1. a) $1048.64
   b) $1024.00
   c) Compound interest yields $24.64 more.

2. a)	b)	c)	d)
$108.50	$218.00	$328.50	$440.00
$117.72	$237.62	$359.71	$484.00
$127.73	$259.01	$393.88	$532.40
$138.59	$282.32	$431.30	$585.64
$150.37	$307.72	$472.27	$644.20
$163.15	$335.42	$517.14	$708.62
$177.01	$365.61	$566.27	$779.49
$192.06	$398.51	$620.06	$857.44
$208.39	$434.38	$678.97	$943.18
$226.10	$434.38	$743.47	$1,037.50
$245.32	$516.09	$814.10	$1,141.25
$266.17	$562.53	$891.44	$1,255.37

CONSUMER MATHEMATICS

LEISURE

LESSON: 1L

AIM: How can we use the spreadsheet to calculate the cost of a new automobile?

PERFORMANCE OBJECTIVES: The student will be able to...

1. Read and interpret the handout they will receive that lists automobile prices.
2. Develop skill entering values and labels by creating a "sticker" for the window of their new car.
3. Use the sum function to determine the total sticker price.
4. Determine the way the spreadsheet calculates by changing the options they wish to purchase using:
   a) The delete command.
   b) The move command.
5. Print and save the worksheet.
6. Clear the screen so that a new "sticker" price may be calculated.

VOCABULARY: sticker price, accessory, automatic recalculation

MOTIVATION:

Distribute the handout on car prices. Pose problem: My budget provides for my purchasing a new car this year. I can only spend $8000, exclusive of sales tax. Is there a car listed on this chart that I can afford?

STUDENT HANDOUT:

1985 CAR PRICE CHART

	CHEVY CAMARO	DODGE DAYTONA	FORD MUSTANG	HONDA PRELUDE	MAZDA RX7	MERCURY CAPRI	NISSAN 200SX	PLYMOUTH CONQUEST	PONTIAC FIERO	RENAULT FUEGO	TOYOTA CELICA	VOLKS. SCIROCCO
BASE PRICE	8530	8505	6885	10345	10945	7944	8999	12564	8495	9295	8449	9980
DESTINATIN CHARGE	414	414	374	179	220	374	200	190	320	395	195	320
AUTOMATIC TRANS.	425	439	439	350	380	439	500	540	425	INCLUDED	460	450
AIR-CONDITIONING	750	737	743	625	650	743	675	793	750	625	690	650
COURTESY LIGHTS	38	30	28	40	50	35	38	125	35	40	32	45
AM/FM RADIO	175	155	138	325	350	225	250	400	235	275	230	290
STEREO CASSETTE	600	570	550	790	800	625	650	975	600	972	770	670
FULL SPARE TIRE	75	75	75	75	75	75	75	75	75	75	75	75
CRUISE CONTROL	175	180	190	185	180	180	190	185	175	190	175	175
REAR-DEFROSTER	135	135	135	150	155	155	160	165	150	160	150	165
TINTED GLASS	95	95	95	100	100	95	100	115	95	100	100	100
POWER STEERING	210	200	190	250	250	220	230	280	200	250	200	260
POWER WINDOWS	200	185	185	225	230	220	230	270	250	260	210	220
RUSTPROOFING	80	75	80	80	80	75	80	80	80	75	80	80
* TOTAL *	11902	11795	10107	13719	14465	11405	12377	16757	11885	12712	11816	13480

DEVELOPMENT:

1. Lead students to understand that when purchasing a car the buyer must consider the base price and the destination charge. Everything else is an option that may or may not be purchased at the discretion of the buyer. The Ford Mustang cost $7259 with no options and $7397 with a radio. In fact if I purchase the Mustang I can choose the following accessories: Automatic Transmission, Courtesy lights, AM/FM radio, and a Rear-Defroster and still keep the price below $8000. What is the price with the options I mentioned? ($7999)

- How much is the Renault Fuego with everything except tinted glass? ($12612) Everything except the stereo cassette? Lead students to express that subtracting $972 cannot be answered as quickly as when subtracting $100. Ask the class if they can suggest a way that the spreadsheet can be used for these calculations. Lead discussion to establish the following:
    - a) The built in SUM function can be used to make calculations easier.
    - b) Formulas can be written to add specific rows and columns.
    - c) The Storage Command enables us to save several different options.
    - d) The delete command can quickly eliminate accessories that we do not want.
    - e) The automatic recalculation ability of the spreadsheet enables the user to see the price change instantaneously when options are deleted.
    - f) The Move Command can temporarily eliminate options still under consideration that we may choose to bring back at a future time.
    - g) The Print Command will give us a hard copy of the "sticker price".

2. Have students enter the data on one car into the spreadsheet. The class should work together to create the first sticker price. Select the Mazda RX7. Enter the name of each option, the car name, the repeating

labels, the cost of each option and the total. When all the data has been entered save the worksheet named Mazda.

- Appleworks: Open Apple-S
- VisiCalc: (/SS, Mazda, Return)

Do not clear the sheet. Try to bring the price down to $12,500. Eliminate the air-conditioning. Position the cursor in the row with the air-conditioning. Use the delete option to eliminate the row.

- Appleworks: (Open Apple-D, Return, Return)
- VisiCalc: (/DR)

Direct student attention to the total price. Elicit that it did not change. Remind students the way the total price was entered. Explain that it was entered as a value, students simply typed in the number. Elicit that if this was entered as an indicated sum then the spreadsheet would find the original total and then recalculate automatically every time we decided not to purchase a given accessory. Move the cursor to the totals row and place it in the cell where the present total (14465) now appears. Enter@SUM(B4.B16). We are making the assumption that the three top columns contain the car name and the separating line. There were originally fourteen items and we deleted one leaving thirteen. Check to see that everything mentioned is in agreement before you press return. Ask students if they think the total will change when they press return. It should change to 13815 as we eliminated the air-conditioning.

3. Continue using the delete command to eliminate the stereo cassette, the power steering and the power windows. This has brought the price down to $12,535. Agree that this is satisfactory and plan to print the sticker to place in the window. If students make mistakes and eliminate incorrect items or erase columns instead of rows then reload the file and begin again.

- Appleworks: Press escape to return to the main menu. Press Return to add files. Press Return to see a menu of the data disk and then move the arrows to select the Mazda file, press Return to load the file. Answer "yes" to "Do you really want to do this?"

- VisiCalc: (/SL, Mazda, Return)

4. Before the sheet is printed pose the following challenge. I just received a $500 tax refund and I will add this to the money I have budgeted for my new car. What accessories can I put back. Elicit that the air-conditioning and the stereo are still out of reach but the power items can now be included. Tell class you really didn't need the power items, what you really want is the air-conditioning. One way would be to eliminate the rear defroster and put back the air-conditioning. Direct the discussion to determine that deleting options from the sheet is only one way to eliminate them from the sum. If we move them out of the way, below the present total, we can put them back if we change our mind. Have class agree that instead of retyping the data we deleted, they will reload the sheet and start from the beginning.

5. Clear the present worksheet.

- Appleworks: Position the cursor in A1 and access the Blank command (Open Apple-B), choose the column option and highlight the two columns that were used. As soon as you press return the sheet will be cleared.
- VisiCalc: (/CY)

Reload the MAZDA file and adjust the total by making it a SUM and not just a value. This time there should be fourteen entries and we would use@SUM(B4.B17), Return. ** EXTREME CARE MUST BE TAKEN THAT ROWS USED AS ENDPOINTS IN OUR FORMULA ARE NOT MOVED. THIS WILL CAUSE ERRORS. TELL STUDENTS NOT TO ELIMINATE THE RUSTPROOFING. The situation caused by moving endpoints of a formula will be explained in detail in the next lesson. **

Remind students that when using the Move Command to move data down we choose the row just below our desired location. When moving data up, our desired location is the row we choose. Following the pattern suggested in the previous example, eliminate the air-conditioning first. Position the cursor in the row that contains the air-conditioning. Plan to move this row to row twenty-five. Access the move command with:

- Appleworks: (Open Apple-M, Return, Return, Return, ↓ (until B26 is reached), Return)
- VisiCalc: (/M, B26, Return)

  Point out the new position for the air, in row 25. Point out the new Total. Let students tell you that the spreadsheet recalculates all data when a move is called for. Continue in the same manner moving the other three items below the position of the air. You will notice that it continually moves up after items above it are eliminated. When the sum reaches 12535, remind the class that now we want to put back the air-conditioning. Do this by positioning the cursor in the row that now contains the air conditioning. Put it back anywhere above the sum using the exact number of the row you have chosen. This time move the cruise control out of the way and decide that this will keep you closest to your budget. If time permits allow students to experiment and see if they can come even closer.

6. Print the "sticker". Decide to use incremental printing mode as our worksheet is small and we will not exceed the paper's width. You will have to consult the printer manual to see what special characters are needed to produce this print. Let us assume that we find that Control-N is the set of special characters that we need. Proceed in the following manner.

- Appleworks: Enter Open Apple-O to choose printer options. SC is the two letter code that you will need to select the special code that you wish to send to the printer. Enter SC, then type Control-N^. Remember to type the caret and not the return key. As soon as the caret is typed you will be returned to the printer option menu. Notice the "yes" that appears next to the option "send characters to printer". The Escape key will return you to the spreadsheet. It might be wise to delete all the unwanted options at this point that lie below the total, then the entire worksheet can be printed by choosing the "all" option. Open Apple-P will access the print command. Press return four times and the "sticker price" will be printed in incremental mode.

- VisiCalc: Enter /PP to access the print option of the print command. Enter " to indicate setup. Whatever you type now will appear on the edit entry line. The code for Control-N is ^CN, the ^C is VisiCalc's code for the control part. If you would like a title such as "Mr. X's Mazda", type it at this time. Remember to end with a carriage return (^R) or two to skip a line (^R^R). The title will print as soon as you press return. Now choose the lower right cell to be printed by entering the coordinates or pointing to the cell with the cursor. Press return and the sheet will print. Make sure that the lower right cell is above the unwanted options. (Just a reminder, Control-N will not work for all printers, check your manual.)

7. Sums may be found by skipping over listed items. For example SUM(B4.B9,B12.B13,B17) will eliminate the items in rows 10, 11, 14, 15, and 16. The new total can be placed below the original. Once the desired SUM has been reached the items can be deleted for the purpose of printing.

APPLICATIONS:

1. Students should be encouraged to select the car of their choice and print their own sticker prices. The best way to handle this is to let student's work independently and have the teacher available to answer questions and solve problems.
2. If the class cannot work independently some suggested stickers follow:

```
MARK'S NEW CAR              BARRY'S NEW CAR
                 TOYOTA                         CHEVY
                 CELICA                        CAMARO
///////////////////////     ///////////////////////
BASE PRICE         8449     BASE PRICE         8530
DESTINATIN CHARGE   195     DESTINATIN CHARGE   414
AM/FM RADIO         230     AUTOMATIC TRANS.    425
FULL SPARE TIRE      75     AIR-CONDITIONING    750
REAR-DEFROSTER      150     COURTESY LIGHTS      38
RUSTPROOFING         80     AM/FM RADIO         175
-----------------------     CRUISE CONTROL      175
     * TOTAL *     9179     REAR-DEFROSTER      135
                            TINTED GLASS         95
                            POWER STEERING      210
                            RUSTPROOFING         80
                            -----------------------
                                 * TOTAL *    11027
```

3. Students could be encouraged to print two "stickers" in an effort to aid them in making decisions.

```
JANIE'S NEW CAR             JANIE'S NEW CAR
               PLYMOUTH                    PLYMOUTH
               CONQUEST                    CONQUEST
///////////////////////     ///////////////////////
BASE PRICE        12564     BASE PRICE        12564
DESTINATIN CHARGE   190     DESTINATIN CHARGE   190
AUTOMATIC TRANS.    540     AUTOMATIC TRANS.    540
AM/FM RADIO         400     AIR-CONDITIONING    793
FULL SPARE TIRE      75     COURTESY LIGHTS     125
REAR-DEFROSTER      165     AM/FM RADIO         400
TINTED GLASS        115     STEREO CASSETTE     975
POWER STEERING      280     FULL SPARE TIRE      75
RUSTPROOFING         80     CRUISE CONTROL      185
-----------------------     REAR-DEFROSTER      165
     * TOTAL *    14409     TINTED GLASS        115
                            POWER STEERING      280
                            POWER WINDOWS       270
                            RUSTPROOFING         80
                            -----------------------
                                 * TOTAL *    16757
```

SUMMARY:

1. Why is it not wise to enter the total sticker price as a value?
2. What is the best way to enter this total?
3. Why is it better to move the option, rather than delete it?
4. Why is it necessary to Save the original sheet with all the options?
5. Is the built in SUM function the only way that totals can be found?
6. What keystroke accesses the built in functions?
7. If I want to move data from row 6 to row 26, what must my destination row be?
8. If I wish to move data from row 26 to row 6, what must my destination row be?
9. How can I retrieve a row that I have erased with the delete option? (You can only retrieve it if you have previously saved the file that contained the row with the Storage Command. Reload the complete file from the disk.)
10. Can I use the sum function to total nonadjacent rows? (Yes, use commas to skip over unwanted rows.)

HOMEWORK:

1. Calculate the sticker price of a Dodge Daytona with every option except rear defroster, tinted glass, power windows and rustproofing.
2. What is more expensive, the Dodge Daytona with all options except the air conditioning or the Toyota Celica with everything except air conditioning and automatic transmission?
3. Assume the Base price is in row 4 and the Rustproofing in row 17. All other options lie between as indicated on our price chart. Write an expression, using the built in

SUM function to calculate the total sticker price without rows 6, 13, 15 and 16.

4. Describe how you would use the spreadsheet to calculate the price of each car including only the base price, the destination charge, the rear defroster, and the AM/FM radio.
5. Find the new totals described in Question 4.
6. If purchasing a car with all the options, which one is the most expensive? The least expensive?
7. How many cars can be purchased with all the accessories offered for under $10,000?
8. How many cars with limited options (example 4) can be purchased for under $10,000? Name them.

HOMEWORK SOLUTIONS:

1. $11,305
2. The Daytona at $11,058 as opposed to the Celica at $10,666.
3. @SUM(B4.B5,B7.B12,B14,B17)
4. Move the Radio and Defroster rows to row 6 and row 7 respectively. Insert a column in row 8. Position the cursor in B8. Enter SUM(B4.B7), Return, replicate across the row from B8 to M8.
5. See next page.
6. Plymouth Conquest, Ford Mustang.
7. None.
8. Seven: Camero, Daytona, Mustang, Capri, Nissan, Pontiac and Celica.

```
           5.

                     CHEVY    DODGE     FORD    HONDA  MAZDA  MERCURY  NISSAN  PLYMOUTH  PONTIAC  RENAULT  TOYOTA    VOLKS.
                    CAMARO  DAYTONA  MUSTANG  PRELUDE    RX7    CAPRI   200SX  CONQUEST    FIERO    FUEGO  CELICA  SCIROCCO
///////////////////////////////////////////////////////////////////////////////////////////////////////////////////////////
BASE PRICE            8530     8505     6885    10345  10945     7944    8999     12564     8495     9295    8449      9980
DESTINATIN CHARGE      414      414      374      179    220      374     200       190      320      395     195       320
AM/FM RADIO            175      155      138      325    350      225     250       400      235      275     230       290
REAR-DEFROSTER         135      135      135      150    155      155     160       165      150      160     150       165
---------------------------------------------------------------------------------------------------------------------------
     * TOTAL *        9254     9209     7532    10999  11670     8698    9609     13319     9200    10125    9024     10755
```

CONSUMER MATHEMATICS

LEISURE

LESSON: 15L

AIM: How can we use the spreadsheet to help us decide what computer to purchase?

PERFORMANCE OBJECTIVES: The student will be able to...

1. Become acquainted with the costs of various computers, peripherals and software by creating a computer price sheet.
2. Become skilled moving data to various locations on the spreadsheet.
3. Differentiate between the procedures for moving data down or right as opposed to up or left.
4. Use the built in sum function to determine the costs of various packages.
5. Understand that the correct sum is preserved when data is moved from the interior of a sum but moving data from an indicated endpoint requires a formula change.

VOCABULARY: peripheral, modem, endpoint

MOTIVATION:

Let's pretend that one of your relatives offered to buy you a computer for your birthday. You were asked to decide what computer you wanted and what software you needed. You were cautioned not to be greedy, to try to find the best buy for the money and the most appropriate computer for your needs. What are some of the factors that you must consider before making a decision?

DEVELOPMENT:

1. Develop a list of considerations with the class.

THE COMPUTER:

- Brand Names
- One or two Drive system
- Size of floppy disk
- Hard disc

PERIPHERALS:

- Monitor:
  - Color
  - Black and white
  - Amber
  - Green
  - Size
- Printer
  - Dot Matrix
  - Thermal
  - Daisy Wheel
  - Laser
  - Carriage size
- Modem
  - Baud rate
  - Internal
  - External
  - etc.

The Aim of this section is to establish with the class what purchasing a computer involves and the type of computer that would suit the needs of an average High School student. For many students, the only computer that they know is the one they work on in school. Consumer Reports did a comparision of the three computers listed below. The prices are approximate. The teacher should add to this list the current computer being used by the class.

COMPUTER PRICE CHART

ACCESSORY	RADIO SHACK TRS-80 MODEL 4P	APPLE IIE PROFESSIONAL	KAYPRO IIX
2-DRIVE COMPUTER	650	1300	1500
PRINTER	450	450	450
WORD PROCESSOR	190	190	190
SPREAD SHEET	200	200	200
UTILITIES	40	40	40
3 GAMES	70	70	70
*** TOTAL ***	1600	2250	2450

a) Students should be made aware of their needs. To run the spreadsheet a one or two, five and one quarter inch floppy disk drive computer is sufficient. The hard disk would be useful to someone in business or for a school that might use a network system. The eight inch floppies are used to store large quantities of data and not necessary in our case.

b) Use the word peripheral and define it for the class as a device used for input/output operation with the computer. If the class uses the term CPU then substitute that for computer. Examples of peripherals are tape recorders, disks, card readers, monitors, printers, modems, any device that is part of a computer system and operates under the control of the CPU.

c) Unless the student is involved with graphics, a color monitor can be an extravagance. A twelve inch green or amber monitor is quite satisfactory.

d) A dot matrix printer for a standard 8in width paper is all that is needed. Most of these printers do a superlative job on student generated high school reports. Letter quality is not necessary for us. The cost is really what makes it out of the question. Another very costly item is the graphics printer. Dot matrix printers with special interface cards or special software can be turned into black and white graphics printers.

e) The modem is another peripheral our students can live without. School offices, school libraries, newspapers and businesses that rely heavily on electronic mail use modems. Banking services, local bulletin boards, and specialized libraries are all within reach of our home computer if we have a modem. Have students evaluate the necessity of purchasing a modem.

2. The price list at the right as well as the one offered in section 1 can be used by the students to select the type of computer they wish to purchase. The software and peripherals listed can be added to their purchase if they choose. This list can be copied for the students or placed on the board. I suggest it be used as an exercise to give students much needed practice in data entry and cursor movements. The ultimate aim of this section is to give students the opportunity to plan the purchase of a computer, as they did at the last meeting with the purchase of an automobile.

3. Review the built in SUM function with the students.

- If finding the sum of an adjacent range of data we use the following method. Access the SUM with@SUM, enter the first and last coordinate of the desired region that we wish to sum, separated by a period. The first and last coordinate are referred to as endpoints. In the expression@SUM(M5.M17) the M5 and the M17 are the endpoints. We are going to assume that the sum will be placed in M18. The sum can be placed anywhere, but because of forward reference (which is described in detail in introductory lesson 5) we would want to put the sum in a cell below M17 or to the right of M17. Wrong answers may occur if a student moves one of these endpoints

```
          COMPUTER STORE SALE

            ----A-------B----
   1         MONITORS
   2        -----------------
   3        COLOR 300      255
   4        COLOR 500      389
   5        COLOR 600      479
   6        COLOR 710      579
   7         12"GREEN      135
   8         12"AMBER      145
   9        AMBER-MAX      185
  10        QUADSC17"     1595
  11        QUDCHROME      465
  12        AMBERCHRO      165
  13
  14         PRINTERS
  15        -----------------
  16        DIABLO 36     1229
  17        DIABLO 25      619
  18        EPSONJX80      599
  19        EPSONLX80      265
  20        EPSONFX80      379
  21        JUKI 6100      439
  22        JUKI 6300      799
  23        SPIRIT 80      279
  24         NEC 2030      719
  25         NEC 2050      695
  26          OKIDATA      409
  27             QUME     1299
  28
  29           MODEMS
  30        -----------------
  31          QUADRAM      555
  32            HAYES      205
  33         PRENTICE      379
  34         NOVATION      475
  35            VADIC      635
  36          VEN-TEL      399
```

when deciding what items to purchase. During a move, all data is recalculated and all formulas are re-referenced. Consider the following situation. A student purchase is:

```
    =====A=========B=====
1     KAYPRO IIX     1500
2     EPSON JX80      599
3     WORDSTAR        179
4     LOTUS           309
5     C.P.A.+         359
6     -------------------
7           Total    2946
```

```
37
38        SOFTWARE
39       -----------------
40        WORDSTAR      179
41           LOTUS      309
42        GEM DRAW       95
43          C.P.A.+     359
44       MULTIPLAN      129
45        NUTSHELL       79
46       INFOSCOPE      125
47            WORD      239
48          SAMNA+      339
```

The formula that generated the total was:@SUM(B1.B5). The student realized that she was over her budget of $2,600 and proceeded to eliminate the C.P.A.+ by moving it out of the SUM. The student chose to move A5 to A10. The cursor was positioned over cell A5 and after the MOVE Command was accessed, the target range of A11 was specified. The total moved up to cell B6. To read the adjusted formula we positioned our cursor over B6 and read SUM(B1...B10).

** THE ORIGINAL ENDPOINT B5 BECAME ENDPOINT B10 **

This means that the sum lies within the sum. This little experiment must be conducted in class to impress on the students the dangers of moving an endpoint to a position that will embrace the sum. Notice the number that represents the sum. It is incorrect because it has added itself. Have students force a recalculation by pressing the exclamation point if using VisiCalc or Open Apple-K, if using Appleworks. Notice the number sum changes again. If you continue to force recalculations, the sum will continually be increased by itself.

4. Not all sums are computed on adjacent rows or columns. The formula SUM(A3...A12,A17,A20...A25,A31) represents one that includes both adjacent rows and nonadjacent rows. If A31 is moved to A41, no error will occur. If A17 is moved to A70, no error will occur. If A20 is moved to A18 and new data is introduced into the sum as a result of this move then errors will occur. Try this experiment with the class.

```
  ==A====B====C====D====E====F====G====H====I====J====K====L====M==
1     7    9   18   35   52   99  121  157  223  398  444 1563
2
```

The formula that generated the SUM in L1 was SUM(A1...K1). Position the cursor over M1, enter the formula SUM(A1...C1,E1,G1...I1,K1) and press return. Move E1 to X1 using Y1 as the specified location X1 is found in the re-referenced formula. Move X1 back to T1, using T1 as the specified location for the target range, again no change. Reason: We are not moving endpoints. Try moving K1, and find that the SUM still does not change. Next, experiment with the endpoints. Try to move all of them to as many different locations as time permits. Develop the following rule. When moving data that represents the endpoint of a range of data in a sum be aware that the new range may include data that you do not want in the sum.

APPLICATIONS:

1. Use the sheet we labeled COMPUTER STORE SALE. Find the sum of the items in B7,B40,B41,B43. Place the answer in C5. Position the cursor in C5 and enter
@SUM(B7,B40,B41,B43).
What is the answer? (982)
Move the data from B40 to B80.
What must the specified target range be? (B81)
Does the sum change? (No)
Why? (B40 did not represent the endpoint of a range of data.)

2. I plan to purchase all software that is on sale. Write a formula that can be used to find the total cost. @SUM(B40...B48) Position the cursor in B50 and enter this formula. What sum appears in B50? (1853) Two word processors are not necessary. Let us eliminate Wordstar. Move it to B30. What is the indicated target range? (B30) Do you expect the sum to change? (Yes, we are moving an endpoint and including B30 through B39 in the range.)

3. Enter the first ten multiples of 5 in the fifth row. Enter a 5 in cell A5. Position the cursor in B5. Enter +A5+5, Return. Replicate this formula across the row with:

- Appleworks: (Open Apple-C, Return, Return, →, Period, →(to J5), Return, →, Return)
- VisiCalc: (/R, Return, B5.J5, Return, R)

Position the cursor in K5, enter SUM(A5.C5,E5,G5.J5), Return, (225). Move E5 to X5. What will the indicated target be? (Y5) Will the sum change? (No, E5 is not an endpoint.) Move X5 to M5. What will the indicated target be? (M5) Will the sum change? (No) All other points are endpoints and the sum can be shown to change if the points are moved to include new data.

SUMMARY:

1. Is the dust cover that we put over the computer at night a peripheral device? (No)
2. How do we know if a device is a peripheral device? (When it is controlled by the computer.)
3. What would be a good printer for high school students?
4. What is a modem?
5. What keystroke forces the spreadsheet to recalculate?
6. In the formula SUM(G6...G60,G66,G90), which, if any, coordinates are endpoints?
7. How would the above formula change if I moved G90 to G99? (It would read SUM(G6...G60,G66,G99).)

8. Would you expect the above move to change the sum? (No)
9. Would you expect the sum to change if I moved G60 to G67? (Yes)

HOMEWORK:

1. Use the computer store sales sheet and write a formula to find the sum of the prices of the following items:
   12" amber monitor
   Juki 6100 printer
   Prentice modem
   Multiplan
   Infoscope
   Word
   Samna+

2. What is the cost of the above package.

3. a) In your answer to exercise 1, name a cell that is an endpoint.
   b) Name a cell that is not an endpoint.

4. What must you enter as the indicated target range when moving:
   a) A34 to A44
   b) F31 to C31
   c) AB13 to X13
   d) AB13 to AB3
   e) D111 to Z111

5. A portion of a spreadsheet is depicted below. Show the change that takes place when you direct the spreadsheet to make the following moves.

```
  --A----B----C----D----E----F----G--
50    1    2    3    4    5    6    7
```

   a) Move C50 to F50
   b) Move G50 to B50

6. A portion of a spreadsheet is depicted below. Show the change that takes place when you direct the spreadsheet to make the following moves.

	===Y===
10	10
11	20
12	30
13	40
14	50
15	60
16	70
17	80
18	90
19	100

a) Move Y10 to Y18

b) Move Y16 to Y12

HOMEWORK SOLUTIONS:

1. SUM(B8,B21,B33,B45...B48)

2. 1745

3. a) B45,B48
   b) B8,B21,B33

4. a) A45
   b) C31
   c) X13
   d) AB3
   e) AA111

5.

	--A--	--B--	--C--	--D--	--E--	--F--	--G--
50	1	2	4	5	3	6	7

	--A--	--B--	--C--	--D--	--E--	--F--	--G--
50	1	7	2	3	4	5	6

6. a)

```
        ===Y===
   10        20
   11        30
   12        40
   13        50
   14        60
   15        70
   16        80
   17        10
   18        90
   19       100
```

6. b)

```
        ===Y===
   10        10
   11        20
   12        70
   13        30
   14        40
   15        50
   16        60
   17        80
   18        90
   19       100
```

CONSUMER MATHEMATICS

LEISURE

LESSON: 17L

AIM: How can we use the spreadsheet to keep track of the statistics of our favorite teams and the players on those teams?

PERFORMANCE OBJECTIVES: The student will be able to...

1. Use the built in average function to compute:
   a) Batting averages.
   b) Earned run averages.
   c) Scoring averages.
2. Update daily statistics from newspaper reports.
3. Write formulas to compute percentages.
4. Use the replicate command to speed calculations on averages and percentages.
5. Use the spreadsheets ability to round data to specific number of decimal places:
   a) Appleworks: Any number through nine.
   b) VisiCalc: Nearest integer and nearest hundredth.
6. Explain the reason that the word ERROR appears on the spreadsheet.

VOCABULARY: statistics, format, align decimal points

MOTIVATION:

What are some of the considerations that our baseball team's coach uses to determine the players that he will retain for the following season, and the ones that will have to be eliminated?

- What are some of the considerations that are used in the major leagues?

DEVELOPMENT:

1. Elicit that careful statistics are kept on each player.

We are concerned with the number of hits a player had relative to the number of times he was at bat, his batting average. We are concerned with a pitcher's earned run average. To calculate that statistic we need to know the number of innings pitched and the numbers of runs earned. We are also concerned with a players RBI's, run batted in, as well as with the number of home runs achieved. Ask students if they think that a baseball coach can use the electronic spreadsheet to aid him in keeping his statistics. Direct student's to verbalize that the spreadsheet is a convenient way to record and save statistics, as well as a powerful tool to use in calculating the above averages. Students should be encouraged to collect statistics from favorite players and favorite teams. Local team and school team statistics should also be available to the student. Newspapers can be used for accuracy or statistics made up from the students imagination.

- Develop the following two formulas with the class.
  a) Batting average = number of hits, divided by, number of at bats.
  b) Earned run average = earned runs * 9, divided by innings pitched.

2. Have students calculate batting averages using the formula developed in section 1a. Offer the class the following statistics on the Mets taken toward the end of the 1985 season (see next page). The chart can be duplicated for each student or placed on the board. Students should enter the data for players name and the statistics for "at bat" and "hits". Titles and column headings can be entered to achieve a neat orderly format. Averages are calculated as follows. Position the cursor over D3 and enter (C3/B3), Return. Replicate this formula in the following manner:

- Appleworks: (Open Apple-C, Return, Return, ↓, Period, ↓ to end of data, Return, →, Return, →, Return)
- VisiCalc: (/R, Return, D4.D21, Return, R, R)

Most team percentages are listed accurate to the third decimal place, the nearest thousandth. Students may want to adjust their sheets:

- **Appleworks:** Position cursor anywhere in column D. Access the Layout Command with Open Apple-L. Choose the Column option and press Return as we are only concerned with this one column. Choose Value Format, and Fixed (decimal format). We will enter a "3" to indicate accuracy to the third decimal place.
- **VisiCalc:** This option is not available to VisiCalc users. We can use the "$" option of the Format command for two decimal places or we can adjust column widths. Understand that all column widths will change and player names will be shortened considerably.

Sample Worksheet:

Mets Statistics

	AT BAT	HITS	AVERAGE
Paciorek	101	30	.297
Hernandez	522	152	.291
Wilson	262	75	.286
Carter	485	138	.285
Heep	255	72	.282
Strawberry	332	93	.280
Backman	457	126	.276
Santana	464	122	.263
Dykstra	231	60	.260
Foster	402	102	.254
Staub	40	10	.250
Bowa	205	49	.239
Johnson	337	80	.237
Reynolds	39	9	.231
Knight	243	50	.206
Hurdle	81	16	.198
Christensen	105	20	.190
Gardenhire	29	5	.172
Beane	1	0	0.000

3. The second formula developed in section one is concerned with the statistics on the pitchers. We need the following statistics to calculate the earned run average. The name of the Pitcher, the number of innings pitched and the number of runs this pitcher is credited with earning. After the data has been entered, the cursor should be positioned in D3 and the formula entered. (C3*9)/B3, Return. The formula is replicated in the same manner as the formula in section 2 was replicated. The earned run average should be entered correct to the nearest hundredth. This is achieved with:

- Appleworks: Follow the same directions as the previous example with the one exception of entering a "2" when asked for the number of decimal places.
- VisiCalc: It is important that the Format option is chosen before the replication is attempted. Otherwise each individual ERA will have to be formatted. Use the following procedure.
- V1. Enter the formula in D3 and press Return.
- V2. Format the entry with (/F$)
- V3. Replicate as outlined in section 2.
- An inspection of the "innings pitched" column shows a poor format. Students should be encouraged to suggest an alternate format so that decimal points can be aligned. Reformatting this sheet can be saved for an application.

DATA FOR EX.4

SUGGESTED WORKSHEET:

```
========A========B========C========D=====
  1 Midtown High School Pitchers
  2                  IP       ER      ERA
  3 Brown            21        7     3.00
  4 Crell            14        5     3.21
  5 Draper         20.2        8     3.56
  6 Evans          23.2        9     3.49
  7 Fine             14        5     3.21
  8 Goody            20        7     3.15
  9 Ho               10        4     3.60
 10 Jory           21.2        8     3.40
 11 Kim              23        9     3.52
 12 Lopez          17.1        6     3.16
 13
 14
 15
 16
 17
 18
-----------------------------------------
```

AMERICAN LEAGUE	WON	LOST
EAST		
TORONTO	91	52
YANKEES	86	57
BALTIMORE	76	66
DETROIT	73	70
BOSTON	71	73
MILWAUKEE	63	79
CLEVELAND	53	93
WEST		
KANSAS CITY	82	61
CALIFORNIA	80	63
CHICAGO	73	69
OAKLAND	70	74
SEATTLE	67	76
MINNESOTA	66	79
TEXAS	52	91

4. Ask students how team standings are calculated? Use the above table showing the number of games won and lost. Direct students to develop the formula Team percentage = games won/games played. Elicit that games played is the sum of the "won" and the "lost" column. Have students enter above data. Position cursor over D3 and enter (B3/(B3+C3)), Return. Call attention to the nested parentheses. Remind students that the spreadsheet calculates parentheses from the inside out and that operations in parentheses are calculated first. Replicate this formula for all data. The result of calculating the formula on the rows without data will be ERROR. Remind students that this is caused by the following chain of events.

   a) When a blank cell is encountered the spreadsheet assumes you entered a zero. Think of cells B10, B11, C10 and C11 as containing zeros.

b) When the formula is replicated relative to rows 10 and 11 it become (B10/(B10+C10)) and (B11/(B11+C11)). After substituting we are aware of what caused the error. We get 0/0 in both cases. An illegal operation. Whenever the spreadsheet encounters division by zero it will declare an error.

- To remove the words ERROR use the Blank command.
- Appleworks: Open Apple-B, choose the block option and highlight only the cells where the word error appears. Then press return and ERROR is erased.
- VisiCalc: Position the cursor over each occurrence of the word error. Enter /B, Return.

The final touch in completing this worksheet is to format the percentage column to three decimal places as described in section 2.

COMPLETED WORKSHEET:

MAJOR LEAGUE STANDINGS ONE DAY IN SEPTEMBER 1985

AMERICAN LEAGUE	WON	LOST	PERCENTAGE
EAST			
TORONTO	91	52	.636
YANKEES	86	57	.601
BALTIMORE	76	66	.535
DETROIT	73	70	.510
BOSTON	71	73	.493
MILWAUKEE	63	79	.444
CLEVELAND	53	93	.363
WEST			
KANSAS CITY	82	61	.573
CALIFORNIA	80	63	.559
CHICAGO	73	69	.514
OAKLAND	70	74	.486
SEATTLE	67	76	.469
MINNESOTA	66	79	.455
TEXAS	52	91	.364

5. Many newspaper accounts of pitching statistics give a player's earned run average along with the games won and lost, the innings pitched and the number of strike outs. If we are interested in knowing the number of earned runs it can be calculated from the information we have. Develop the following formula with the students.

ER = (ERA * IP)/9

Refer to the table of Mets Pitchers listed below. Enter the names in column A, the wins in column B and the number of games lost in column C. When entering the Innings Pitched column you will notice how the spreadsheet treats zeros to the right of the decimal point. 71.0 will be entered as 71.

- Appleworks users can format this column after it has been entered with the fixed decimal option of the Value format of the Layout Command.
- VisiCalc: Not available.

Enter the data for Strike Outs and then the ERA. When entering 5.30 you will encounter the same problem as when 71.0 was entered. The spreadsheet will not enter zeros that trail to the right of the decimal point. These entries will have to be formatted after they are entered.

- Appleworks: Use the Layout Command and choose two fixed decimal places.
- VisiCalc: Use the Format Command and choose the "$" option. Generate column G with the formula (F3*E3)/9 and the replicate command. Point out to the class the 3 entries that are in tenths.

Berenyl	3.8
Latham	5.9
Gardener	6.7

Since we are dealing with runs here we must round to the nearest integer.

- Appleworks: Use the Layout Command and choose zero fixed decimal places.
- VisiCalc: Use the "I" option of the Format Command. Place the cursor over each of the 3 entries depicted above and type /FI.

COMPLETED WORKSHEET:

METS PITCHERS

//////////////	WON	LOST	IP	SO	ERA	ER
Gooden	21	4	250.2	247	1.62	45
Leach	3	3	44.2	23	2.42	12
Berenyl	1	0	13.2	10	2.63	4
Fernandez	6	9	141.1	152	2.74	43
Darling	16	5	220.1	150	2.74	67
Orosco	6	5	71.0	50	2.92	23
MacDowell	6	5	108.2	61	2.98	36
Lynch	10	7	185.1	61	3.25	67
Aguilera	7	6	97.1	58	3.33	36
Latham	1	1	13.0	8	4.15	6
Gorman	4	4	51.0	32	4.94	28
Sisk	4	5	73.0	24	5.30	43
Schiraldi	2	1	26.1	21	8.89	26
Gardener	0	1	6.1	4	9.95	7

APPLICATIONS:

1. One day the Yankees ended an eight game loosing streak with a victory over Baltimore. The score was Yanks 5, Orioles 2. The Yankee's statistics follow. Calculate each players Batting average.

YANKEES

///////////	AT BATS	HITS	AVERAGE
Henderson	5	2	.400
Griffey	4	3	.750
Mattingly	5	1	.200
Winfield	5	2	.400
Hassey	3	1	.333
Baylor	4	1	.250
Pagliarul	5	2	.400
Hudler	4	1	.250
Meacham	5	0	0.000

2. Describe how the spreadsheet can be used to round these batting averages to the nearest hundredth.

3. Consider the following section of a spreadsheet.

```
    Universal League Standings
      ---F------G------H------I------J---
     9  Team    Won   Lost  Percentage
    10  Winners   15     5           .75
    20  Losers     1    19           .05
```

   a) Assume there are 11 teams listed. Write a formula that will generate the percentage column.

   b) Describe how you would generate this column using the spreadsheet's commands.

SUMMARY:

1. What formula is used to calculate a player's batting average?

2. What formula is used to calculate a pitchers ERA?

3. How are team percentages calculated?

4. What display will we see on the spreadsheet when we enter 7.0? 50.0?

5. What command do we use to round specific decimals to a given number of decimal places?

6. What command will round all decimals? (Students need to be reminded every now and then of the procedures used when making global changes.) Appleworks uses the Standard Values Command (Open Apple-V). VisiCalc uses the global command (/G).

7. What number does the spreadsheet assign to cells that contain no values?

8. How do we interpret the word ERROR when it appears on the spreadsheet?

9. What command is used as a fast way of erasing unwanted data? (The Blank Command.)

HOMEWORK:

1. Use the table at the right to calculate the percentage for each National League Team.
   a) Write a formula that will find the percentage.
   b) Describe how you would replicate the formula in column D.
   c) What will be the display in rows 10 and 11 as a result of this replication.
   d) Explain why this occurs.
   e) Complete the table.

NATIONAL LEAGUE	WON	LOST
EAST		
ST. LOUIS	88	55
METS	87	56
MONTREAL	77	66
PHILADELPHIA	69	72
CHICAGO	66	76
PITTSBURG	47	94
WEST		
LOS ANGELES	84	58
CINCINNATI	76	66
HOUSTON	73	70
SAN DIEGO	71	71
ATLANTA	60	83
SAN FRANCISCO	56	87

2. The statistics for the Orioles in the game that broke the Yankee's loosing streak are listed at the right. Calculate the batting average for each player in this game and round the average to the nearest thousandth.

BALTIMORE

///////////////	AT BATS	HITS
Wiggins	3	0
Sheets	1	0
Lacy	5	2
Ripkin	4	0
Murray	2	0
Yong	3	0
Dwyer	3	1
Shelby	4	1
Rayford	4	1
Dempsy	2	0
Gross	1	0

3. Let us assume the following false results for the Yankee players. Imagine that each player increased his hits by 2. If the At Bats remainded the same the statistics would look like the table to the right. Use this table to calculate new battling averages and round your answer to the nearest thousandth.

YANKEES

////////////	AT BATS	HITS
Henderson	5	4
Griffey	4	3
Mattingly	5	3
Winfield	5	4
Hassey	3	2
Baylor	4	3
Pagliarul	5	4
Hudler	4	3
Meacham	5	2

4. Assume that you are replicating the following formulas. How many times must relative change be chosen in each case.
   a) +B1*C1/7
   b) (H7+N7)*3-T5
   c) @SUM(A1...A25)/25
   d) (V3+W3)*(X3+Y3)

5. Explain how the spreadsheet calculates the formula (A3*((T2-T8)/6))?

HOMEWORK SOLUTIONS:

1. a) +B3/(C3+B3)
   b) - Appleworks:
      - A1. Position the cursor over D3, the cell that contains the formula.
      - A2. Open Apple-C to access the replicate command.
      - A3. Press return twice to choose within worksheet and highlight the source.
      - A4. Press the down arrow, the period and then hold the down arrow depressed until the complete target range is highlighted. End with a return.
      - A5. Choose relative change 3 times.

- VisiCalc:
- V1. Position the cursor over D3, the cell that contains the formula.
- V2. /R, Return to access the replicate command.
- V3. (D4.D16) to indicate the target range, Return, to end.
- V4. Choose R three times.

c) ERROR

d) The word ERROR will occur due to the fact that the spreadsheet assumes a zero fills the empty cells and when the formulas is calculated division by zero occurs. This illegal operation causes the sheet to display the word error.

e)

MAJOR LEAGUE STANDINGS ONE DAY IN SEPTEMBER 1985

AMERICAN LEAGUE	WON	LOST	PERCENTAGE
EAST			
ST. LOUIS	88	55	.615
METS	87	56	.608
MONTREAL	77	66	.538
PHILADELPHIA	69	72	.489
CHICAGO	66	76	.465
PITTSBURG	47	94	.333
WEST			
LOS ANGELES	84	58	.592
CINCINNATI	76	66	.535
HOUSTON	73	70	.510
SAN DIEGO	71	71	.500
ATLANTA	60	83	.420
SAN FRANCISCO	56	87	.392

2)

BALTIMORE

//////////	AT BATS	HITS	AVERAGE
Wiggins	3	0	0.000
Sheets	1	0	0.000
Lacy	5	2	.400
Ripkin	4	0	0.000
Murray	2	0	0.000
Yong	3	0	0.000
Dwyer	3	1	.333
Shelby	4	1	.250
Rayford	4	1	.250
Dempsy	2	0	0.000
Gross	1	0	0.000

3)

YANKEES

///////////	AT BATS	HITS	AVERAGE
Henderson	5	4	.800
Griffey	4	3	.750
Mattingly	5	3	.600
Winfield	5	4	.800
Hassey	3	2	.667
Baylor	4	3	.750
Pagliarul	5	4	.800
Hudler	4	3	.750
Meacham	5	2	.400

4) a. 2   b. 3   c. 2   4. 4

5) First T8 is subtracted from T2, then the difference is divided by 6. Finally the quotient is multiplied by A3.

CONSUMER MATHEMATICS

LEISURE

LESSON: 18L

AIM: How can we use the spreadsheet to project future college costs?

PERFORMANCE OBJECTIVES: The student will be able to...

1. Use the given table to calculate the cost of a four year college education.
2. Generate the years by using a formula and the replicate command.
3. Use the format command to justify correctly when adjacent columns are used for one heading.
4. Use the " to indicate labels that begin with keystrokes other than letters.
5. Explain that the inflation factor represents a projected 6% increase in yearly college costs.
6. Write the formula and use the replicate command to complete the table.
7. Experiment with $ and % to be used as repeating labels.
8. Use the storage and print command to save the worksheet.

VOCABULARY: factor, inflation factor, asset

MOTIVATION:

- If the cost of the college that you have chosen to attend is $3000 a year, what can you expect to pay for a four year education?
- If your young brother, who is still in elementary school decides to attend the same college will it cost him the same as it costs you?
- Assume your older sister is presently a junior in that same college. This year her tuition payment was $3000. Is it possible that it was less last year? Could it possibly go up next year? Would you like to change your answer to any of the previous questions?

DEVELOPMENT:

1. First establish that due to the rising cost of living, inflation, and general price increases the cost of a four year college education can only be estimated. Tell students that consumer reports estimates the average cost of a private college education for the 1985-86 school year to be $9022 and the average cost for a public education to be $4881.

   Ask them to estimate the cost of the 1986-87 year based on a 6% increase in costs. Offer the table to the right. Challenge students to predict the new costs for the next four years based on a 6% increase each year. Elicit that the calculations will be time consuming. Have students suggest entering the information on the spreadsheet and using the power of Appleworks/VisiCalc to do the calculations quickly. Have students enter the data onto their worksheets.

COLLEGE OR UNIVERSITY	TUITION ROOM AND BOARD
$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$	
PRINCETON UNIVERSITY	13930
CARLTON COLLEGE	10900
ILLINOIS WESLEYAN	8910
SOUTHERN CALIFORNIA COLLEGE	6156
U OF TEXAS (ARLINGTON)	4100
UNIVERSITY OF OKLAHOMA	3092

2. Lead a student discussion on how to determine yearly costs. Find 6% of the first years cost and use that new number as the cost of the second year. Repeat this process four times until the fourth years cost is determined. The sum of these four numbers will be the projected total tuition. Ask students if the totals calculated could represent the cost to them personally. It will if they are seniors, for anyone else, more calculations are needed. Ask the class how many yearly costs will have to be calculated to estimate the cost of a college education for a student that is currently in the third grade? Lead them to understand that they will make their first payment in 10 years and then make three additional payments. Tell students that even for the

spreadsheet this becomes an arduous task. Fortunately alternate methods exist.

3. Before the calculations are attempted inform students that tables have been created to ease the burden of this chore for people who do not own computers with electronic spreadsheet. Offer students the above table. Tell them that the word factor refers to one of the numbers in a multiplication example. Explain that the inflation factor is based on a yearly rate of inflation of 6%. This factor will be used to update the cost of a four year education. Step one is to compute the cost of four years, based on the current college cost. Let us assume that the "Tuition Room and Board" has been entered in column C and occupies cells C3...C8. Position the cursor in cell D3 and enter +C3*4, Return. Replicate this down the column to determine the four year cost, before inflation.

NUMBER OF YEARS UNTIL YOU BEGIN	INFLATION FACTOR
%%%%%%%%%%%%%%	%%%%%%%%%%%%%%
0	1.12
2	1.26
4	1.42
6	1.59
8	1.79
10	2.01

- Appleworks: (Open Apple-C, Return, Return, ↓ , Period, ↓ to C8, Return, →, Return)
- VisiCalc: (/R, Return, C3.C8, Return, R)

Interpret the inflation factor table with the students. In this table we will assume that the college plan on raising its tuition every other year. If you are currently a junior or senior you will choose "0" years until you begin, the freshmen and sophomores will choose "2" and for that third grade sibling, we choose "10". Use the spreadsheet to do the calculations and develop the formulas. For juniors and seniors. Position the cursor over E3. Enter +E3*1.12, Return. Emphasize that 1.12 is the inflation factor that gives us a more realistic estimate of the actual cost that we may expect to pay. Replicate down the column with the procedure outlined above. Since both formulas used to generate columns D and E respectively contain only one variable each, the copy procedure is identical. Compare columns D and E, discuss the monetary discrepancy.

4. Format the spreadsheet in the following manner.

- Appleworks: Column A can be adjusted to the width of 27 characters. Appleworks permits for variable column widths. The label for column A only requires 21 characters so the first 5 characters of the word "Tuition" can be placed in this column. The next 17 characters can be placed in column B. Thus the first two columns are adjusted to contain 27 and 17 characters respectively.
- VisiCalc: We need 22 characters for each label. If we want to use one line and not divide the titles among two rows then use three columns of 15 characters each as variable column widths are not available.
  Labels are naturally left justified, thus adjacent letters in any one word will not appear separated. A problem will occur however if you attempt to begin a column with a space. In that case use the " keystroke before entering any data. This will allow any character to be entered as a label.

5. Insert a row below the titles and above the data in the body of the sheet for the purpose of inserting a delineator. We have used the dollar sign for the college sheet and the percent sign for the inflation factor sheet. Permit students to be imaginative with this insert. Position the cursor anywhere in row 2:

- Appleworks: (Open Apple-I, Return, 1, Return) Position cursor in A2. Depress whatever key the class chooses as a delineator. Hold it down until the desired region has been filled. The class may choose a key that is not permissible for a label, such as a value key or a key that does not represent either a value or label such as the "*". This will have to be entered by using the " keystroke first.
- VisiCalc: (/IR) to insert the row. Move the cursor to A2 and (/-) to access the repeating label command. Then whatever key the student wants and Return. For the

percent key, (/-%) will fill the column width with a line of percents and leave the cursor over cell A2. This will have to be replicated across row 2 with (/R, Return, B2.E2, Return).

6. Have students save the worksheet named College. Once the file is saved the worksheet should be cleared. Ask students if they know how these college costs can be met. Discuss scholarships, grants, loans. Have students offer realistic estimates of the contribution they can make by working summers and after school. Offer students the following table of family income and family assets. Name this file income. This guide is similar to ones being used in financial aid offices of various colleges across the country. Explain how to read the table. A family with an income of $12,000 and assets of up to $40,000 cannot be expected to pay anything toward the cost of a college education. Discuss the type of assets that a family may have. Money in the bank, a car, a home, perhaps securities. Elicit that this information would be very useful to parents when helping to plan the students future education. Have students agree to enter the data on the spreadsheet and then print the sheet so that it can be shown
   to family members.
   The sheet that appears on the right has been printed by Appleworks using a global dollar format with zero decimal places. The command sequence follows.

```
YOUR INCOME   YOUR ASSETS
BEFORE TAXES  $20,000  $40,000  $80,000
$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$
    $12,000        $0       $0     $740
    $20,000      $590     $940   $2,070
    $28,000    $1,830   $2,200   $3,900
    $36,000    $3,420   $3,890   $6,150
    $44,000    $5,460   $5,970   $8,230
    $60,000    $9,640  $10,150  $12,400
```

- Appleworks:
  (Open Apple-V, Return, →, Return, 0, Return)
- VisiCalc:
  This format can be achieved if desired. Use the " keystroke and enter each cell individually. For VisiCalc I would recommend the dollar and cents format. Enter all data and then use (/GF$).

7. Before printing the worksheet have class decide on the size of print, the type of spacing, and the number of lines per inch. Once this is established, set printing parameters.

- Appleworks: (Open Apple-O) to access the printer options.
  - .A1 Size of print: Enter SC for special character and then enter whatever character your printer uses for the type of print you desire. Make sure that you end your entry with the ^ keystroke.
  - .A2 Spacing: Enter SS, DS, or TS.
  - .A3 Lines per inch: Enter L1 and change to 8, or leave the default value of 6.
  - .A4 Print the sheet with (Open Apple-P, Return, Return, Return, Return).
- VisiCalc: Position the cursor in cell A1.
  - .V1 (/PP) to access the print command.
  - .V2 Default is double space, enter "-" for single spacing.
  - .V3 Enter the " keystroke to indicate Setup. For escape-Q, enter ^EQ, make sure to end line with at least one carriage return ^R.
  - .V4 Enter the lower right coordinates and press return.

APPLICATIONS:

1. Load the worksheet named College saved previously.

- Appleworks: This sheet should still be on the desktop. Use option 2 of the Main Menu. "Work with one of the files on the desk top." Use the small window menu to reload this file.
- VisiCalc: (/SL, College, Return)

We are going to rearrange the data on this sheet. Plan on changing the name to "Costly".

2. Delete the top three rows, the ones that contain the titles and the delineators. Next delete the columns with college names so that only the college costs remain. Position the cursor anywhere in row 1.

- Appleworks: (Open Apple-D, Return, ↓, ↓, Return) Position cursor in A1. (Open Apple-D, →, Return, Return)
- VisiCalc: (/DR, /DR, /DR) Position cursor in cell A1. (/DC, /DC)

3. Insert a blank column in row 1 for the purpose of generating the years. Position the cursor in row 1.

- Appleworks: (Open Apple-I, Return, 1, Return)
- VisiCalc: (/IR)

Insert the following column headings.

A	B	C
Yearly $	4 Year $	1985

Students may be concerned that the date is expressed in dollar mode. This is because the sheet contained a global change that effects every cell on the sheet, with or without data. They may suggest entering it as a label the " keystroke first. Remind them we want to generate the years and if 1985 is entered as a label we cannot use it as a variable in our formula.

4. Write a formula that will generate the remaining years. +C1+2 Position the cursor in cell D1, enter the formula and press Return, 1987 appears in D1 and the cursor remains in that cell. Replicate this formula across the row and format it properly.

- Appleworks: (Open Apple-C, Return, Return, →, Period, →, →, →, Return, →, Return, Open Apple-L, →, Return, Return, Return, →, →, →, →, Return)
- VisiCalc: Position the cursor in C1 (/FG, →, /FG, /R, Return, E1.H1, Return, R).

5. Complete the body of the sheet by writing formulas that will generate the 1987 through 1995 columns. Position the cursor over D2. Enter +B2*1.26, Return.

- Appleworks: (Open Apple-C, Return, Return, ↓, Period, ↓ to row 7, Return, →, Return)
- VisiCalc: (/R, Return, D3.D7, Return, R)
- To generate 1989 column, position cursor over E2, enter +B2*1.42, Replicate.

- To generate 1991 column, position cursor over F2, enter +B2*1.59, Replicate.
- To generate 1993 column, position cursor over G2, enter +B2*1.79, Replicate.
- To generate 1995 column, position cursor over H2, enter +B2*2.01, Replicate.

6. Save the "Costly" worksheet.
    - Appleworks: If you have not already changed the name do so now with Open Apple-N. Then access the save command with Open Apple-S.
    - VisiCalc: (/SS, Costly, Return)

Completed Worksheet

Yearly $	4 Year $	1985	1987	1989	1991	1993	1995
$13,930	$55,720	$66,864	$70,207	$79,122	$88,595	$99,739	$111,997
$10,900	$43,600	$52,320	$54,936	$61,912	$69,324	$78,044	$87,636
$8,910	$35,640	$42,768	$44,906	$50,609	$56,668	$63,796	$71,636
$6,156	$24,624	$29,549	$31,026	$34,966	$39,152	$44,077	$49,494
$4,100	$16,400	$19,680	$20,664	$23,288	$26,076	$29,356	$32,964
$3,092	$12,368	$14,842	$15,584	$17,563	$19,665	$22,139	$24,860

SUMMARY:

1. Why is it necessary for families to plan for the cost of a college education?
2. What word can be used to describe the terms in a multiplication example?
3. How can labels that begin with non label keystrokes be entered on the spreadsheet?
4. Approximately what percent do colleges use to estimate their yearly inflation rate?
5. How are these inflation factors used to estimate the cost of a college education?
6. Are colleges interested in anything besides family income when considering financial aid?
7. How are special characters sent to the printer while still in the spreadsheet?

8. When using Appleworks, that happens when you try to load a file, from the disk, that has already been placed on the desktop?

9. What are some of the special uses that VisiCalc assigns to the " keystroke?

HOMEWORK:

1. Describe how you would enter the years 1940, 1950, ..., 2000 in column A.

2. a) Use the worksheet named Costly to estimate how many times greater the cost of a Carlton education will be for people starting in 1995, rather than 1985.
   b) Write a formula that can be used to find the exact difference between the cost of a four year education in 1985 and one ten years later in 1995. Place your answer in the I column.
   c) Write a formula that will place in column J how many times greater the 1995 costs are then the 1985 costs.

3. a) Calculate column I.
   b) Calculate column J.
   c) Is there a relationship between the original cost and the number of times that the price has increased.

4. Use the Income file to determine if a family earning $36,000 before taxes with $20,000 in assets can afford to send their child to the University of Oklahoma this year.

5. Describe what the income and assets of a family must be in order to afford a Carlton education, this year.

HOMEWORK SOLUTIONS:

1. Enter 1940 in A1 press Return, position the cursor in A2 and enter +A1+10, Return, Replicate this formula down column A ending with 2000 in A7.

2. a) 1.5 b) (H2-C2) c) (H2/C2)

3. a) b) c) Yes, either 1.67 or 1.68

I	J
$45,133	1.67
$35,316	1.67
$28,868	1.67
$19,945	1.68
$13,284	1.68
$10,018	1.68

4. Yes

5. $60,000 with $80,000 in assets.

CONSUMER MATHEMATICS
MATHEMATICS IN THE HOME
LESSON: 3L

AIM: How can we use the electronic spreadsheet to adjust recipies, determine calorie intake and calculate meal costs?

PERFORMANCE OBJECTIVES: The student will be able to...

1. Develop skill in entering data by typing several recipes onto the spreadsheet.
2. Understand why the spreadsheet changes fractions to decimals and predict the result of entering 1/4, etc.
3. Create formulas that will:
   a) Adjust recipes.
   b) Count calories.
   c) Determine the size of one portion.
4. Use the replicate command to:
   a) Copy the formulas.
   b) Adjust the amount of each ingredient.
   c) Copy the list of ingredients.
5. Use the Delete Command to eliminate unwanted data from rows or columns.
6. Use the repeating label command to simulate lines?
7. Save and clear the worksheet.
8. Reload previously saved files.

VOCABULARY: cursor, data, replicate, source range, target range

MOTIVATION:

What built in function does the spreadsheet have that will help us count calories? (The sum.)
What information must we give the spreadsheet before we can ask for the sum? (The necessary data.)
What will the necessary data be if we are interested in counting calories? (The foods that we eat and their calorie count.)

DEVELOPMENT:

1. Students should be given the opportunity to enter data into the spreadsheet. A suggested list of calories follows. This can be duplicated for the class or placed on a chalkboard or on a chart where it is visible to the students. The aim of this section is for every student to have some "hands on" experience.

- Appleworks: Remind students that the delete key erases unwanted characters as they enter their data, the escape key will eliminate the entire entry as they enter data and the Open Apple-U and Open Apple-E are used to edit data that has already been entered.
- VisiCalc: Remind students that the Backspace key erases unwanted characters as they enter their data, the escape key can be used to erase the entire entry. If they wish to edit their data after it has been entered they use the "/E" and CTRL-E can be used in the body of the spreadsheet.

  Arrows are used to move the cursor and cannot be used to back up over unwanted characters. If arrows are depressed the cell entry will be completed and the cursor will advance to the next cell in the direction of the depressed arrow.

SUGGESTED WORKSHEET

CALORIES

CALORIE COUNT	FOR VARIOUS FOODS	
Apple, raw	1 large	117
Banana, raw	1 large	176
Beans, green cooked	1 cup	27
Beef, round, cooked	3.2 ounces	214
Bread, white, enriched	1 slice	63
Broccoli, cooked	2/3 cup	29
Butter	1 tablespoon	100
Cabbage, cooked	1/2 cup	20
Carrots, raw	1 cup shredded	42
Cheese, american	1 ounce	113
Chicken, fried	1/2 breast	232
Egg, boiled	1 medium	77
Liver, Beef, fried	1 slice	86
Margarine, fortified	1 tablespoon	101
Milk, whole, cow's	6 ounces	124
Oatmeal, cooked	1 cup	148
Orange, whole	1 medium	68
Pork, shoulder, roasted	2 slices	320
Tomatoes, raw	1 large	40
Potatoes, white, baked	1 medium	98
Rice, white, cooked	1 cup	201
Sugar, white	1 tablespoon	48

2. If an exact duplication of the sheet is desired, students can be shown how to enter a value as a label. This is necessary to create the vertical and horizontal lines. The quote key is a signal to the spreadsheet that a label is being entered. If a number or a key that is not defined as a number or label is preceded by the " keystroke then it will be entered as a label.

- Appleworks: Row one contains the Title. Position the cursor in A2 and enter ". Depress the - key and hold it down until the entire line has been entered. To add the vertical line I used the vertical line key that appears below the delete key on the upper right of the keyboard. I entered this in B3 and replicated it down the column. Since Appleworks provides for various column widths I used a one character column for each vertical line. Changing column widths is not part of this lesson. The sequencing of various units has been left to the discretion of individual teachers. The GUIDE that accompanies the computer lessons will direct the teacher to lessons where this, or any, topic is handled in detail.

- VisiCalc: The horizontal line is made with the repeating label command. Position the cursor in A2 and enter (/-, -, Return) this sequence will fill the column with minus signs. The column can be replicated across row 2 or the above sequence can be used in each column in row 2 until the end has been reached.

3. a) After the sheet has been completed advise students to save it immediately.
   - Appleworks: (Open Apple-S)
   - VisiCalc: (/SS, CALORIES, RETURN)

   b) Have students use the Delete Command to narrow the sheet to only selected meal items. Discuss appropriate selections for meals. Pose questions such as:
   Would cooked cabbage be a good selection for breakfast?
   Would it be wise to select Pork and Beef for Lunch?
   Permit students to make their own selections.
   Position the cursor in the first row that you wish to delete. Use the Delete Command as follows:
   - Appleworks: (Open Apple-D, Return) arrow down to highlight the adjacent rows that you wish to erase then press return. Repeat this procedure until only the sample meal remains on the sheet.
   - VisiCalc: (/DR) for each row that you wish eliminated from the spreadsheet. Use the arrows to pass over the food that you have selected for your meal.

c) If repeating labels were used on the top of the sheet they can be used on the bottom as well. Create the bottom delineator at this time.

d) Find the sum of the calorie counts for your meal. Place the cursor in the cell below the last calorie count (or the delineator if used). Assume the cursor is positioned in E9. Assume the calorie count has been placed in column E. Enter @SUM(E3.E8), Return. The Sum now appears in E9.

e) Students may change the Title by erasing the entry VARIOUS FOODS and entering their own name and the desired meal. The Blank Command should be used to erase. Position the cursor over the cell that contains VARIOUS FOODS.

- Appleworks: (Open Apple-B, Return)
- VisiCalc: (/B, Return)

SAMPLE MEALS

```
          CALORIE COUNT     FOR PAULA'S BREAKFAST
--------------------------------------------------
Butter                      1 tablespoon       100
Egg, boiled                 1 medium            77
Milk, whole, cow's          6 ounces           124
Oatmeal, cooked             1 cup              148
Orange, whole               1 medium            68
Sugar, white                1 tablespoon        48
--------------------------------------------------
                                               565
```

```
          CALORIE COUNT     ED'S LUNCH
--------------------------------------------------
Bread, white, enriched      1 slice             63
Butter                      1 tablespoon       100
Cabbage, cooked             1/2 cup             20
Milk, whole, cow's          6 ounces           124
Orange, whole               1 medium            68
Pork, shoulder, roasted     2 slices           320
Rice, white, cooked         1 cup              201
--------------------------------------------------
                                               896
```

CALORIE COUNT FOR AMY'S DINNER

Apple, raw	1 large	117
Beans, green cooked	1 cup	27
Beef, round, cooked	3.2 ounces	214
Bread, white, enriched	1 slice	63
Butter	1 tablespoon	100
Milk, whole, cow's	6 ounces	124
Tomatoes, raw	1 large	40
Potatoes, white, baked	1 medium	98
		783

4. Ask students if they know how to cook, or have any favorite recipes. Guide discussion to establish that recipes are written for a specific number of portions. Elicit that the power of the spreadsheet can be applied to adjusting these recipes for any number of portions. Establish that first recipes must be entered on the spreadsheet and then formulas can be written to adjust the number of portions. Students should be encouraged to offer suggested recipes. Two samples follow if none are forthcoming. Before data is entered the following must be discussed.
    a) Emphasize the entry of values in specific columns or rows. The spreadsheet cannot operate on labels. If we wish to perform numeric operations it must be on values, not labels. Once students learn how to enter values as labels with the quote key, they like to use this technique so they can place the number exactly where they want it. When they do this they do not understand why the built in functions, or the entry of a simple formula, will not work. If the teacher positions the cursor over the numbers being operated upon the cell indicator line will reveal if the cell contains a label or a value. Have students carefully enter the data for a given recipe. Make sure the number of portions is included.

b) Discuss the entry of fractional parts. Have students understand that if they cannot figure out the decimal equivalent of a fractional part the spreadsheet will do it for them. Pose questions such as:

- If a recipe calls for a half a cup, how can I enter the 1/2?
- What is the decimal equivalent of 2/3?
- If I do not know a decimal equivalent, how can I find my answer?

c) Teach students that decimal equivalents can be found by entering the fraction as an indicated division and letting the spreadsheet find the answer. For example when I enter 1/2, the spreadsheet display is .5. If 3/4 is entered the cell would display .75.

5. Write formulas that will adjust recipes for specific portions. Assume a recipe is written for 6 portions.

- How can I adjust this recipe for 3 portions? Take each item and divide it by two.
- How can we use the power of the spreadsheet to do this?
- Assume A is the column where the values appear and F is the column where we want our recipe that serves 3.
- Position the cursor in F2 and enter +A1/2, Return.
- Replicate this formula with relative change down column F.
- Appleworks: (Open Apple-C, Return, Return,↓ , Period,↓ to end of ingredients, Return, →, Return.)
- VisiCalc: (/R, Return, F3.F6, Return, R.)

6. Use the replicate command to copy the names of the ingredients. Remind students that when they copy data that does not include formulas they will not be asked to select relative change or no change.

- Assume the ingredient's names are located in column B and we wish to copy them into column G.
- Position the cursor in B2 and access the replicate command.
- Appleworks: (Open Apple-C, Return, to B6 to highlight source, Return, → to G2 to indicate starting point, Return.)

This completes the recipe for 3 portions. In a similar manner the recipe can be adjusted for 4 and 12 portions. It might be wise to leave this for an application and enter a second recipe with the class. We leave to the discretion of the teacher the arrangement of these topics. The amount covered in a lesson will depend on the number of students in the class and the computer student ratio.

```
  CHOCOLATE MOUSSE
  *****************
  SERVES 6          SERVES 3          SERVES 4             SERVES 12
6TSP. SUGAR       3TSP. SUGAR       4.02TSP. SUGAR       12TSP. SUGAR
6TSP. SUGAR       3TSP. SUGAR       4.02TSP. SUGAR       12TSP. SUGAR
6OZ. CHOCOLATE    3OZ. CHOCOLATE    4.02OZ. CHOCOLATE    12OZ. CHOCOLATE
6 EGGS SEPARATED  3 EGGS SEPARATED  4.02 EGGS SEPARATED  12 EGGS SEPARATED
1TSP. VANILLA     .5TSP. VANILLA     .67TSP. VANILLA     2TSP. VANILLA
```

```
   BOSTON BAKED BEANS
   ******************
   SERVES 6              SERVES 3              SERVES 4              SERVES 12
1.00POUND BEANS       .50POUND BEANS       1.49POUND BEANS       2.00POUND BEANS
1.50TSP. SALT         .75TSP. SALT         2.24TSP. SALT         3.00TSP. SALT
  .25CUP BROWN SUGAR  .12CUP BROWN SUGAR    .37CUP BROWN SUGAR     .50CUP BROWN SUGAR
  .25CUP MOLASSES     .12CUP MOLASSES       .37CUP MOLASSES        .50CUP MOLASSES
1.00TSP. DRY MUSTARD  .50TSP. DRY MUSTARD  1.49TSP. DRY MOLASSES 2.00TSP. DRY MUSTARD
1.00SMALL ONION       .50SMALL ONION       1.49SMALL ONION       2.00SMALL ONION
  .25POUND SALT PORK  .12POUND SALT PORK    .37POUND SALT PORK     .50POUND SALT PORK
```

APPLICATIONS:

1. Write formulas that will adjust recipes:
- For 4 portions +A2*.67 or +A2*2/3.
- For 12 portions +A2*2.

Replicate these formulas and copy the lists of ingredients with the copy command as described in the development.

2. Save the worksheet and clear it so that we may enter another set of data.
   - Appleworks: (Open Apple-S, Escape) We have now returned to the main menu and will clear the current worksheet. Choose option 4, REMOVE FILES FROM THE DESKTOP. After pressing return we are shown a catalog of the files on the desktop. Position the cursor over the recipe file and press return. You will be given three choices. We are interested in number three. You will be asked the following questions.
   - Throw out the changes to the file?
   - Do you really want to do this?

     Use the following sequence of keys (3, Return, →, Return). At this point we have been returned to the MAIN MENU. We have told Appleworks to throw out the changes, but we saved our file in advance so there is nothing to worry about. When we are asked if we really want to we respond, "yes". Thus the file is removed and we are free to select the Spreadsheet, option 5 of the Add Files Menu, and make a new file From Scratch.
   - VisiCalc: (/SS, MOUSSE, RETURN, /CY) The file has been saved, the sheet has been cleared and we are ready to repeat the procedure outlined above with a second recipe.
3. The CALORIE file should be reloaded and students can select meals as they did in the development. Clear the worksheet as described above.
   - Appleworks: (From the MAIN MENU - Return, Return, Move cursor to file we named CALORIES, Return.)
   - VisiCalc: (/SL, CALORIES, RETURN.)

SUMMARY:

1. If an incorrect character appears while data is being entered, what key will erase it?

2. If errors are spotted after data has been entered, how can they be corrected?

3. What command erases rows or columns and then moves all data to fill the vacated spaces? (The delete command.)

4. What command erases data and leaves an empty row, column, or entry? (The blank command.)
5. What keystroke is used to allow a value to be entered as a label?
6. How can I enter a % or a * into the spreadsheet? (Precede it with a ".)
7. What built in function totals numeric data?
8. How are repeating labels generated?
9. What will the display be if I entered 3/4?

HOMEWORK:

1. Write a formula that can be used to make the following adjustments to a recipe written to Serve 8. Assume the values are placed in the C column and occupy rows 5 through 9.
   a) To serve 2.
   b) To serve 4.
   c) To serve 16.
   d) To serve 12.
   e) To serve 3.
2. Use the calorie list to find the total number of calories in the following meal.

Fried chicken	1 whole breast
Beans, green	1/2 cup
Baked potato	medium
Butter	2 tablespoons
Apple	1 large

3. Explain how the spreadsheet enters the following fractions.
   a) 1/2
   b) 1/4
   c) 3/4
   d) 3/2
   e) 2/3

4. The following recipe makes 4 dozen cookies.

2-1/2 cups	flour
1/2 pound	butter
1/2 cup	sugar
1	egg
1 tsp.	vanilla

Adjust this recipe for:

a) 8 dozen cookies.
b) 16 dozen cookies.
c) 2 dozen cookies.
d) 6 dozen cookies.
e) 1 dozen cookies.

HOMEWORK SOLUTIONS:

1. a) 2/8 * C5
b) 4/8 * C5
c) 16/8 * C5
d) 12/8 * C5
e) 3/8 * C5

2. 2*232 = 464
27/2 = 13.5
98
2*100 = 200
117
892.5

3. a) .5
b) .25
c) .75
d) 1.5
e) .666...7

4. a)

5 cups	flour
1 pound	butter
1 cup	sugar
2	eggs
2 tsp.	vanilla

b)

10 cups	flour
2 pound	butter
2 cup	sugar
4	eggs
4 tsp.	vanilla

c)

1-1/4 cups	flour
1/4 pound	butter
1/4 cup	sugar
1/2	egg
1/2 tsp.	vanilla

d)	3-3/4	cups	flour
	3/4	pound	butter
	3/4	cup	sugar
	1-1/5		egg
	1-1/5	tsp.	vanilla
e)	5/8	cups	flour
	1/8	pound	butter
	1/8	cup	sugar
	1/4		egg
	1/4	tsp.	vanilla

CONSUMER MATHEMATICS
MATHEMATICS IN THE HOME
LESSON: 12L

AIM: How can we use the electronic spreadsheet to calculate areas, perimeters and volumes?

PERFORMANCE OBJECTIVES: The student will be able to...

1. Access and use the built in value of PI (VisiCalc).
2. Enter numeric data by:
    a) Typing each entry.
    b) Generate lists by copying one entry.
    c) Generate lists by replicating a formula.
3. Write formulas for:
    a) Area and circumference of circles.
    b) Perimeter and area of rectangles.
    c) Volumes of rectangular solids, pyramids, cylinders and spheres.
4. Be aware of errors due to the spreadsheet's manner of calculating from left to right. PI*A4 2 must be entered as PI*(A4^2).
5. Use global value formatting as opposed to local formatting.
6. Use the repeating label command to neatly format the worksheet.

VOCABULARY: generate a list, global formatting

MOTIVATION:

Kathy was given an order to make nine circular doilies. She planned on using white linen trimmed with cotton lace. How can the spreadsheet be used to assist Kathy with this project?

DEVELOPMENT:

1. Elicit that the spreadsheet can not be used to make the

doilies but it can be used to calculate the amount of material Kathy has to purchase. To find the amount of linen she will need to purchase Kathy must be concerned with the area of the doily. To find the amount of lace, she will need to know the circumference. The spreadsheet can be used to calculate these areas and circumferences by entering the radius of each doily and calculating using the appropriate formula. Elicit that each formula need only be entered once. The remaining eight answers can be generated by the replicate command. Have students enter the radius for each doily in column A beginning in row 5. Use the following numbers: 10, 1/2, 25, 36, 17, 104, 50, 72, 88.
Ask students to predict the display when 1/2 is entered. Enter the Title CIRCLES in B1. Enter the column headings RADIUS in A3, CIRCUM. in B3, and AREA in C3.

2. Generate the dividing lines in the following manner. Position the cursor in A2:

- Appleworks: (", depress the * until the C column has been filled, move cursor to A4, enter ", depress the - until the C column has been filled.)
- VisiCalc: (/-, *, Return, /R, Return, B2.C2, Return, Position cursor in A4, /-, -, Return, /R, Return, B4.C4, Return.)

3. Position the cursor in B5 and prepare to enter the circumference formula. Elicit C = Pi*2*r. The variable r is located in A5. The required formula will be 2*A5*Pi.

- Appleworks: The value of Pi will have to be approximated. We will use 22/7. Enter 2*A5*22/7, Return, prepare to replicate this down column B. (Open Apple-C, Return, Return, ↓, Period, ↓ to B13, Return, →, Return)
- VisiCalc: This program has a built in value of Pi. By entering Pi the value of Pi is generated by the sheet. Before using this value in a formula permit students to see the value by entering @Pi in any cell and reading the value thus generated. When students are convinced that this is an excellent approximation write the formula @Pi*2*A5. When this formula is entered in B5 and Return

is pressed the value 62.83185 will appear. Replicate down column B with (/R, Return, B6.B13, Return, R).

4. To generate the Area a new formula must be used. Elicit A = Pi*r 2. Remind students that the spreadsheet calculates from left to right and gives no operation precedence. We want only the radius squared so that we must enclose this in parentheses, a signal to the spreadsheet to calculate that amount first. Our formula will look like this. A = Pi*(r^2). Position the cursor in C5:

- Appleworks: (22/7*(A5^2), Return, Open Apple-C, Return, Return, ↓, Period, ↓ to C13, Return, >, Return.)
- VisiCalc: (@Pi*(A5^2), Return, /R, Return, C6.C13, Return, R.)

Completed sheet:

```
                 CIRCLES
    ********************************
    RADIUS    CIRCUM.       AREA
    --------------------------------
     10         62.83185     314.1593
     .5         3.141593     .7853982
     25         157.0796     1963.495
     36         226.1947     4071.504
     17         106.8142     907.9203
     104        653.4513     33979.47
     50         314.1593     7853.982
     72         452.3893     16286.02
     88         552.9203     24328.49
```

5. Have students criticize the appearance of the data just generated.

- Decimal points are not aligned.
- The values are difficult to read as they occupy the complete cell.

Introduce the Standard Values command and discuss global formatting as opposed to formatting individual columns.

We want to align all the decimal points in all three columns. When a change is made that effects every value on the sheet we choose the Global Command. Select the format that will round decimals to two places.

- Appleworks: (Open Apple-V, Return, Return, 2, Return)
- VisiCalc: (/GF$)

6. Elicit that we still do not know how much material to purchase. To find this answer we must take the sum of each column that we generated. Position the cursor in A14 and draw another dividing line as described in section 2. Replicate this line across columns B and C. Position the cursor in B15. Enter@Sum(B5.B13), Return. Move the cursor to C15 and find the Sum of the areas. Point out to students the fact that the SUMS are formatted properly. Conclude that since the sheet was reformatted globally all cells were included in the reformatting. This includes blank cells as well. Discuss the unit of measure. Formulate statements such as.

- We must purchase at least 2,530 inches of lace.
- We must purchase at least 90,000 Square inches of linen.

Completed Worksheet:

```
              CIRCLES
********************************
RADIUS    CIRCUM.       AREA
--------------------------------
 10.00      62.83        314.16
  0.50       3.14          0.79
 25.00     157.08       1963.50
 36.00     226.19       4071.50
 17.00     106.81        907.92
104.00     653.45      33979.47
 50.00     314.16       7853.98
 72.00     452.39      16286.02
 88.00     552.92      24328.49
--------------------------------
          2528.98      89705.82
```

APPLICATIONS:

1. Find the volumes of various rectangular solids. Format the worksheet as we did in the development. Provide a row for the Title RECTANGULAR SOLIDS. Use the column headings LENGTH, WIDTH, HEIGHT, and VOLUME. Neatly format the sheet with dividing lines.

2. To speed the entry of data, enter a 5 in the first cell of the length (A5). Prepare to copy this value into the next nine cells with the replicate command.

- Appleworks: (Open Apple-C, Return, Return, ↓, Period, ↓ to A14, Return)
- VisiCalc: (/R, Return, A6.A14, Return)
- Generate the widths by entering a 15 in B5 and entering and replicating the formula (B5+2) for the rest of the column. Position the cursor in B6. Enter (B5+2), Return, Replicate as described above.
- Select a new formula to generate the heights. The one used in the sample is (C5-3). Enter a 66 in C5 and move the cursor to C6. Enter (C5-3), Return. Replicate down the C column.

4. Elicit the formula for the volume of a rectangular solid. V = l*w*h. Translate into one that can be used on the spreadsheet. Position the cursor in D5. Enter A5*B5*C5, Return, Replicate this formula down column D with three relative changes, for each of the three variables in the formula.

Completed Worksheet:

```
    RECTANGULAR SOLIDS
********************************
LENGTH  WIDTH  HEIGHT VOLUME
------------------------------
 5       15      66      4950
 5       17      63      5355
 5       19      60      5700
 5       21      57      5985
 5       23      54      6210
 5       25      51      6375
 5       27      48      6480
 5       29      45      6525
 5       31      42      6510
 5       33      39      6435
```

SUMMARY:

1. How are lists of data generated?
2. In what order does the spreadsheet carry out calculations?
3. How can we indicate what operation we want calculated first?
4. What type of a change is used to reformat every value on the spreadsheet?
5. Does the spreadsheet automatically align decimal points?
6. When we elect to display values that are rounded to 2 decimal places, are these the numbers that the program uses when it calculates? (No! The program remembers the original value and uses that value when calculating.)
7. Does a global change reformat cells that have no data in them? (A global change reformats every cell, if data is entered in blank cells after global changes are made the display will be consistent with the global change.)

HOMEWORK:

1. a) Write a formula that can be used to find the perimeter of a rectangle.
   b) Adjust this formula to use on a spreadsheet with lengths entered in column A and widths in column B.

2. a) Write a formula that can be used to find the area of a rectangle.
   b) Adjust this formula to use on a spreadsheet with lengths entered in column A and widths in column B.

3. Find the perimeter and area for the following rectangles:

	length	width
a)	16	34
b)	21	3/4
c)	68	41
d)	35	89
e)	72	2

4. The formula for the volume of a cone is V = 1/3 Pi r^2 h. Assume the radius is in cell T7 and the height is in U7. Write a formula that will cause the spreadsheet to find this volume and enter it in V7.

5. Write a formula that can be used with the replicate command to generate the following lists of data. Assume the first entry in each case is in cell H9.
   a) 1, 2, 3, 4, 5, 6, 7, 8
   b) 12, 17, 22, 27, 32, 37, 42, 47
   c) 1, 3, 9, 27, 81, 243
   d) 97, 87, 77, 67, 57, 47, 37, 27, 17
   e) 800, 400, 200, 100, 50, 25

HOMEWORK SOLUTIONS:

1. a) P = 2*(l+w)
   b) Position the cursor in C1.
   Enter 2*(A1+B1).

2. a) A = l*w
   b) Position the cursor in D1.
   Enter A1*B1.

3.

```
               RECTANGLES
**********************************
LENGTH  WIDTH  PERIMETER     AREA
----------------------------------

 16      34       100       544
 21      .75      43.5      15.75
 68      41       218       2788
 35      89       248       3115
 72      2        148       144
```

4. Position the cursor in V7.

   Appleworks: Enter 22/7/3*(T7 ^ 2)*U7.

   VisiCalc: Enter @Pi/3*(T7^ 2)*U7.

   Answer 513.1268

5. a) +H9+1
   b) 5+H9
   c) (H9*3)
   d) +H9-10
   e) (H9/2)

CONSUMER MATHEMATICS

MATHEMATICS IN THE HOME

LESSON: 19L

AIM: How can we use the electronic spreadsheet to make a chart that lists each degree of temperature in both fahrenheit and celsius?

PERFORMANCE OBJECTIVES: The student will be able to...

1. Create a formula to generate a list of numbers from 0 to 255.
2. Use the formula C=(5/9)*(F-32) and the replicate command to calculate the celsius equivalents.
3. Relate below freezing to negative numbers and generate a list from -40 to 100.
4. Use the formula F=(9/5)*(C)+32 and the replicate command to calculate the fahrenheit equivalents.
5. Adjust decimal places to different accuracies using the layout or format options.
6. Develop ease using the window command to retain sections of the worksheet on the screen, that would otherwise scroll out of view.
7. Save and print a neatly formatted chart with a title.

VOCABULARY: fahrenheit, celsius, scroll

MOTIVATION:

What do I mean when I say the temperature outside is below zero?

- Is it the same as saying the temperature is below freezing?
- Who uses these different temperature scales?
- Is there a number where the fahrenheit and celsius temperatures are equal?

DEVELOPMENT:

1. Lead class to understand that it would take endless hours to convert every degree of fahrenheit temperature to celsius and visa versa. If we let the spreadsheet do the work we could investigate temperatures that rarely occur in our environment or on our planet. While we are mainly concerned with the outdoor temperature, scientists in research and industry might experiment with temperature far below the freezing point, or above the boiling point of water. Have students conjecture whether the temperature readings will ever be the same. Elicit the formulas that will be needed for the conversion and place them on the board. Plan the worksheet.
    a) If we begin the chart with 1 degree fahrenheit we choose a temperature over 30 degrees below freezing. To equalize this choose a temperature in excess of 30 degrees above the boiling point. If we want to print the sheet on a single page, and the greatest number of lines that the average printer can put on a page is 88 we see that we cannot use a single column to generate the fahrenheit readings. In our sample we chose 3 columns of 85 entries each giving us a range of 1 degree through 255 degrees. Thus columns A, D and G will be used to contain the fahrenheit temperature.
    b) Enter the heading Fahrenheit in column A, Celcius in column B and plan to use the lower case o, which looks like a degree symbol as a vertical divider between consecutive columns. We will center this symbol and replicate the three titles across row one through column I.
    c) Column A will begin with 1 and the formula that will generate the temperatures will be 1 + A2. Column D will begin with 86 and the formula to generate the temperatures will be 1 + D2. In a similar manner begin column G with 171 and generate the column with +G2+1.
    d) The celsius columns will be B, E and H. They will be generated by replicating the formulas, 5/9*(A2-32),

5/9*(D2-32) and 5/9*(G2-32) respectively.

2. Create the chart.

   a) Enter the column headings Fahrenheit and Celsius. Enter the "o" and center it with:

   - Appleworks: The label format center option of the Layout command. (Open Apple-L)
   - VisiCalc: Enter the " keystroke, three spaces, and then the lower case "o".

   Replicate these three column headings twice, with the Copy Command.

   b) Enter a 1 in A2. Position the cursor in A3 and enter 1+A2, Return:

   - Appleworks: (Open Apple-C, Return, Return, Period, ↓ to A86, Return, →, Return)
   - VisiCalc: (/R, Return, A4.A86, Return, R)

   In a similar manner enter 86 in D2 and 171 in G2. Generate the remainder of these columns with the formulas defined in section 1C and the replicate commands described above.

   c) Position the cursor in B2 and enter 5/9*(A2-32), replicate as described above. In a similar manner generate the E and the H columns.

   d) The "o" can be replicated down columns C, F and I. Since this is not a formula it will not be necessary to choose Relative Change. The procedure is the same in every other way. The sheet should be complete.

3. Discuss the value format of the worksheet. Columns B, E and H are difficult to read. Decimal points are not aligned and there is no uniformity in the number of digits. Have the class agree to change to a rounded decimal format.

- Appleworks: Select Fixed format with one decimal place. Access the Layout Command. Position the cursor in column B. (Open Apple-L, →, →, Return, Return, Return, Return, 1, Return). Move the cursor to columns E and then H, repeating the above procedure both times.
- VisiCalc: The only available formats are 0 or 2 decimal places. Use the dollar format and round to 2 decimal

places. Position the cursor in column B. (/F$) Move the cursor to columns E and then H, repeating the above procedure both times. Format before replicating the formula.

4. Point to the negative numbers in the celsius column. Have students relate the negative numbers to below freezing. Explain that in celsius temperature, below freezing is also below zero. Have students find the freezing and boiling point of water. Emphasize the relationship of 0 degrees to 32 and 100 degrees to 212. Discuss the spread from freezing to boiling. 180 degrees for Fahrenheit and 100 degrees for Celsius.

5. Ask students what the fahrenheit equivalent of 3 or 4 degrees celsius is. Continue the challenge with 21, 22, 23, or 24. Elicit that these numbers are not on the chart and can only be estimated. Pose problem: Is there a way for us to find the exact values? Hopefully the students will suggest making a new chart using the formula F=(9/5)*C+32. Save the current worksheet before beginning the next one.

- Appleworks: (Open Apple-S)
- VisiCalc: (/SS, Tempconv, Return)

See Sample Sheet at End of Lesson.

6. Our Celsius sample sheet (also located at the end of the lesson) ranges from -40 to 79. It is important to include the -40, as that is the point where the temperatures are the same. Making this sheet should serve as a reenforcement of the preparation for the previous chart. Plan the worksheet:
    a) This time we begin with the Celsius temperature. Columns A, D and G will be generated with 1+A2, 1+D2, and 1+G2 respectively.
    b) Columns B, E, and H will be generated by the formulas (9/5)*A2+32, (9/5)*D2+32, and (9/5)*G2+32 respectively.
    c) The column headings as well as the delineators in columns C, F and I will be the same in both charts. If the teacher chooses a horizontal dividing line can

be placed in row 2 by inserting a row, after the sheet is completed, or entering it before the numbers are generated.

7. Ask students to make a generalization about the amount of degree change on the fahrenheit scale for every 20 degrees of change on the celsius scale. This will be difficult for students to read as a page holds only 18 rows. Introduce the Window Command. This command has the advantage of putting any two rows or columns next to each other while still being able to access all regions of the spreadsheet. When we place a window into our spreadsheet we access what we call the "splitscreen". It was given the name splitscreen because when you look at the display system you see a dividing line that causes the display to resemble two headings twice. Once on top of the sheet, where we expect them, and again in the horizontal bar that split our screen into two windows. Similarly, a vertical divider will contain all the row numbers and split the screen into two side by side windows. If we wish to place any two rows in an adjacent manner we must divide the sheet with a horizontal line and use a top and bottom window. To place any two columns in adjacent positions use a vertical divider and choose side by side windows. Have the class agree to place 30 degrees celsius under 10 degrees celsius. Position the cursor under the 10, or anywhere in row 13, assuming the 10 degrees celsius lies in row 12.

- Appleworks:
  - .A1 Open Apple-W, to access the window command.
  - .A2 →, RETURN to select a top and bottom window.
  - .A3 Open Apple-W, →, Return: to synchronize the scroll between the two windows.
  - .A4 Open Apple-J to jump the cursor between the two windows.
- VisiCalc:
  - .V1 /WH to access the window command, and choose a horizontal divider.
  - .V2 /WS to synchronize the scroll
  - .V3 The semicolon ";" to jump the cursor between windows.

A horizontal bar containing the row numbers now appears beneath the row that contains the -30, 10 and 50 degree celsius readings. Position the cursor in the bottom window and scroll the data until the row that contains the -10, 30 and 70 degree celsius readings occupies the top row of the bottom window. Compare the fahrenheit readings. Have a student verbalize. For every 20 degree celsius difference, there is a 36 degree fahrenheit difference. Attempt to elicit the relationship that exist between the 180:100 degree spread and the 36:20 spread just discovered.

```
========A========B========C========D========E========F========G========H====
  1:CELSIUS FAHRENHEIT    o    CELSIUS FAHRENHEIT    o    CELSIUS FAHRENHEIT
  2:ooooooooooooooooooooooooooooooooooooooooooooooooooooooooooooooooooooooooo
  3:        -40    -40.0    o            0     32.0    o          40    104.0
  4:        -39    -38.2    o            1     33.8    o          41    105.8
  5:        -38    -36.4    o            2     35.6    o          42    107.6
  6:        -37    -34.6    o            3     37.4    o          43    109.4
  7:        -36    -32.8    o            4     39.2    o          44    111.2
  8:        -35    -31.0    o            5     41.0    o          45    113.0
  9:        -34    -29.2    o            6     42.8    o          46    114.8
 10:        -33    -27.4    o            7     44.6    o          47    116.6
 11:        -32    -25.6    o            8     46.4    o          48    118.4
 12:        -31    -23.8    o            9     48.2    o          49    120.2
 13:        -30    -22.0    o           10     50.0    o          50    122.0
========A========B========C========D========E========F========G========H====
 33:        -10     14.0    o           30     86.0    o          70    158.0
 34:         -9     15.8    o           31     87.8    o          71    159.8
 35:         -8     17.6    o           32     89.6    o          72    161.6
 36:         -7     19.4    o           33     91.4    o          73    163.4
---------------------------------------------------------------------------
```

EXAMPLE OF SPLITSCREEN WITH HORIZONTAL DIVIDER, A TOP AND BOTTOM WINDOW.

8. Remind students of the way that a window is cleared and the display returned to its normal state.
- Appleworks: (Open Apple-W, Return) to choose the "one" option, for one screen, no longer a split screen.
- VisiCalc: (/W, One) to choose the "one" option, for one screen, no longer a split screen.

Have students practice splitting the screen into two side by side windows by choosing a vertical dividing line.

APPLICATIONS:

1. Ask students to find the spread in fahrenheit temperature

for every 10 degrees in celsius. Have them create a window below 25 degrees celsius. After positioning 35 below 25 have students verbalize that there is an 18 degree spread in the fahrenheit temperature for every 10 degrees celsius. With the cursor still positioned in the bottom window move the left arrow to emphasize how the window moves in an unsynchronized fashion.

UNSYNCHRONIZED SAMPLE

```
              REVIEW/ADD/CHANGE
==B========C========D========E======
   3.2    o            24      75.2
   5.0    o            25      77.0
==D========E========F========G======
    35      95.0    o             75
    36      96.8    o             76
    37      98.6    o             77
    38     100.4    o             78
    39     102.2    o             79
```

SYNCHRONIZED SAMPLE

```
                  REVIEW/ADD/CHANGE
==B========C========D========E========F
   3.2    o            24      75.2    o
   5.0    o            25      77.0    o
==B========C========D========E========F
  23.0    o            35      95.0    o
  24.8    o            36      96.8    o
  26.6    o            37      98.6    o
  28.4    o            38     100.4    o
  30.2    o            39     102.2    o
```

2. Have students continue the spreadsheet to include the celsius values through 89. Format this column for two fixed decimal places. Save and print the worksheet.

```
80    176.00
81    177.80
82    179.60
83    181.40
84    183.20
85    185.00
86    186.80
87    188.60
88    190.40
89    192.20
```

3. Clear the worksheet and reload the Tempconv sheet.

- Appleworks: Return to the main menu, choose option 2 and work with one of the files on the desktop.
- VisiCalc: (/CY, /SL, TEMPCONV, RETURN) Extend this sheet through 266 degrees fahrenheit.

```
256   124.44
257   125.00
258   125.56
259   126.11
260   126.67
261   127.22
262   127.78
263   128.33
264   128.89
265   129.44
266   130.00
```

4. Clear the sheet and load the recipe file saved in a previous lesson. Select the BOSTON BAKED BEANS recipe. Plan on placing the recipes that serve 6 and 12 in an adjacent fashion. Select a vertical divider to split the screen into two side by side windows.

   Sample Splitscreen

```
File: RECIPES                  REVIEW/ADD/CHANGE              Escape
========A===========B===========C===========G===========H=========I=
11:          BOSTON BAKED BEANS      11:
12:          ******************      12:
13:          SERVES 6                13:        SERVES 12
14:       1.00POUND BEANS            14:     2.00POUND BEANS
15:       1.50TSP. SALT              15:     3.00TSP. SALT
16:        .25CUP BROWN SUGAR        16:      .50CUP BROWN SUGAR
17:        .25CUP MOLASSES           17:      .50CUP MOLASSES
18:       1.00TSP.DRY MUSTARD        18:     2.00TSP.DRY MUSTARD
19:       1.00SMALL ONION            19:     2.00SMALL ONION
20:        .25POUND SALT PORK        20:      .50POUND SALT PORK
21:----------------------------------21:---------------------------
22:                                  22:
```

SUMMARY:

1. Assume there is a "2" in cell A1. What formula will generate consecutive even numbers down column A?
2. If I changed cell A1 to "1", instead of the "2", would the formula you suggested still generate even numbers?
3. Why do I need two formulas to calculate celsius and fahrenheit?
4. Under what circumstances would I choose to use the window command?
5. How do I return the splitscreen to my original display?
6. What does -2 fahrenheit mean?
   - What does -2 celsius mean?
   - Which one means two degrees below freezing?
7. At what temperature are the fahrenheit and celsius readings the same?

HOMEWORK:

1. Find the celsius equivalents of the fahrenheit temperatures from 267 degrees to 280 degrees inclusive. Round answers to nearest hundredth.
2. Find the fahrenheit equivalents of the celsius temperatures from 90 to 100 degrees inclusive. Round answers to the nearest hundredth.
3. Write a formula that can be used to:
   a) Convert fahrenheit temperature to celsius temperature.
   b) Convert celsius temperature to fahrenheit temperature.
   c) Generate a list of multiples of 5 in column W, when there is a 5 in W1.
   d) Generate a list of multiples of 3 in column T, when there is a 3 in T1.
4. What is the smallest positive number that must be placed in cell A1 to generate the given list using the replicate command and the following formulas?
   a) A list of even numbers with 2+A1.
   b) A list of odd numbers with 2+A1.
   c) A list of multiples of ten with 10+A1.
   d) A list of multiples of four with 4+A1.

HOMEWORK SOLUTIONS:

1.

267	130.56
268	131.11
269	131.67
270	132.22
271	132.78
272	133.33
273	133.89
274	134.44
275	135.00
276	135.56
277	136.11
278	136.67
279	137.22
280	137.78

2.

CELSIUS	
90	194.00
91	195.80
92	197.60
93	199.40
94	201.20
95	203.00
96	204.80
97	206.60
98	208.40
99	210.20
100	212.00

3a) C = (5/9)*(F-32)

b) F = (9/5)*C+32

c) 5 + W1

d) +T1 + 3

4a) 2 b) 1 c) 10 d) 4

File: TEMPCONV

```
FAHRENHEIT   CELSIUS   o   FAHRENHEIT   CELSIUS   o   FAHRENHEIT   CELSIUS   o
         1     -17.2   o           86      30.0   o          171      77.2   o
         2     -16.7   o           87      30.6   o          172      77.8   o
         3     -16.1   o           88      31.1   o          173      78.3   o
         4     -15.6   o           89      31.7   o          174      78.9   o
         5     -15.0   o           90      32.2   o          175      79.4   o
         6     -14.4   o           91      32.8   o          176      80.0   o
         7     -13.9   o           92      33.3   o          177      80.6   o
         8     -13.3   o           93      33.9   o          178      81.1   o
         9     -12.8   o           94      34.4   o          179      81.7   o
        10     -12.2   o           95      35.0   o          180      82.2   o
        11     -11.7   o           96      35.6   o          181      82.8   o
        12     -11.1   o           97      36.1   o          182      83.3   o
        13     -10.6   o           98      36.7   o          183      83.9   o
        14     -10.0   o           99      37.2   o          184      84.4   o
        15      -9.4   o          100      37.8   o          185      85.0   o
        16      -8.9   o          101      38.3   o          186      85.6   o
        17      -8.3   o          102      38.9   o          187      86.1   o
        18      -7.8   o          103      39.4   o          188      86.7   o
        19      -7.2   o          104      40.0   o          189      87.2   o
        20      -6.7   o          105      40.6   o          190      87.8   o
        21      -6.1   o          106      41.1   o          191      88.3   o
        22      -5.6   o          107      41.7   o          192      88.9   o
        23      -5.0   o          108      42.2   o          193      89.4   o
        24      -4.4   o          109      42.8   o          194      90.0   o
        25      -3.9   o          110      43.3   o          195      90.6   o
        26      -3.3   o          111      43.9   o          196      91.1   o
        27      -2.8   o          112      44.4   o          197      91.7   o
        28      -2.2   o          113      45.0   o          198      92.2   o
        29      -1.7   o          114      45.6   o          199      92.8   o
        30      -1.1   o          115      46.1   o          200      93.3   o
        31       -.6   o          116      46.7   o          201      93.9   o
        32       0.0   o          117      47.2   o          202      94.4   o
        33        .6   o          118      48.3   o          203      95.0   o
        34       1.1   o          119      48.3   o          204      95.6   o
        35       1.7   o          120      48.9   o          205      96.1   o
        36       2.2   o          121      49.4   o          206      96.7   o
        37       2.8   o          122      50.0   o          207      97.2   o
        38       3.3   o          123      50.6   o          208      97.8   o
        39       3.9   o          124      51.1   o          209      98.3   o
        40       4.4   o          125      51.7   o          210      98.9   o
        41       5.0   o          126      52.2   o          211      99.4   o
        42       5.6   o          127      52.8   o          212     100.0   o
        43       6.1   o          128      53.3   o          213     100.6   o
        44       6.7   o          129      53.9   o          214     101.1   o
        45       7.2   o          130      54.4   o          215     101.7   o
```

46	7.8	o	131	55.0	o	216	102.2	o
47	8.3	o	132	55.6	o	217	102.8	o
48	8.9	o	133	56.1	o	218	103.3	o
49	9.4	o	134	56.7	o	219	103.9	o
50	10.0	o	135	57.2	o	220	104.4	o
51	10.6	o	136	57.8	o	221	105.0	o
52	11.1	o	137	58.3	o	222	105.6	o
53	11.7	o	138	58.9	o	223	106.1	o
54	12.2	o	139	59.4	o	224	106.7	o
55	12.8	o	140	60.0	o	225	107.2	o
56	13.3	o	141	60.6	o	226	107.8	o
57	13.9	o	142	61.1	o	227	108.3	o
58	14.4	o	143	61.7	o	228	108.9	o
59	15.0	o	144	62.2	o	229	109.4	o
60	15.6	o	145	62.8	o	230	110.0	o
61	16.1	o	146	63.3	o	231	110.6	o
62	16.7	o	147	63.9	o	232	111.1	o
63	17.2	o	148	64.4	o	233	111.7	o
64	17.8	o	149	65.0	o	234	112.2	o
65	18.3	o	150	65.6	o	235	112.8	o
66	18.9	o	151	66.1	o	236	113.3	o
67	19.4	o	152	66.7	o	237	113.9	o
68	20.0	o	153	67.2	o	238	114.4	o
69	20.6	o	154	67.8	o	239	115.0	o
70	21.1	o	155	68.3	o	240	115.6	o
71	21.7	o	156	68.9	o	241	116.1	o
72	22.2	o	157	69.4	o	242	116.7	o
73	22.8	o	158	70.0	o	243	117.2	o
74	23.3	o	159	70.6	o	244	117.8	o
75	23.9	o	160	71.1	o	245	118.3	o
76	24.4	o	161	71.7	o	246	118.9	o
77	25.0	o	162	72.2	o	247	119.4	o
78	25.6	o	163	72.8	o	248	120.0	o
79	26.1	o	164	73.3	o	249	120.6	o
80	26.7	o	165	73.9	o	250	121.1	o
81	27.2	o	166	74.4	o	251	121.7	o
82	27.8	o	167	75.0	o	252	122.2	o
83	28.3	o	168	75.6	o	253	122.8	o
84	28.9	o	169	76.1	o	254	123.3	o
85	29.4	o	170	76.7	o	255	123.9	o

```
File:  CELSIUS

CELSIUS FAHRENHEIT    o    CELSIUS FAHRENHEIT    o    CELSIUS FAHRENHEIT    o
ooooooooooooooooooooooooooooooooooooooooooooooooooooooooooooooooooooooooooooo
      -40    -40.0    o            0     32.0    o           40    104.0    o
      -39    -38.2    o            1     33.8    o           41    105.8    o
      -38    -36.4    o            2     35.6    o           42    107.6    o
      -37    -34.6    o            3     37.4    o           43    109.4    o
      -36    -32.8    o            4     39.2    o           44    111.2    o
      -35    -31.0    o            5     41.0    o           45    113.0    o
      -34    -29.2    o            6     42.8    o           46    114.8    o
      -33    -27.4    o            7     44.6    o           47    116.6    o
      -32    -25.6    o            8     46.4    o           48    118.4    o
      -31    -23.8    o            9     48.2    o           49    120.2    o
      -30    -22.0    o           10     50.0    o           50    122.0    o
      -29    -20.2    o           11     51.8    o           51    123.8    o
      -28    -18.4    o           12     53.6    o           52    125.6    o
      -27    -16.6    o           13     55.4    o           53    127.4    o
      -26    -14.8    o           14     57.2    o           54    129.2    o
      -25    -13.0    o           15     59.0    o           55    131.0    o
      -24    -11.2    o           16     60.8    o           56    132.8    o
      -23     -9.4    o           17     62.6    o           57    134.6    o
      -22     -7.6    o           18     64.6    o           58    136.4    o
      -21     -5.8    o           19     66.2    o           59    138.2    o
      -20     -4.0    o           20     68.0    o           60    140.0    o
      -19     -2.2    o           21     69.8    o           61    141.8    o
      -18      -.4    o           22     71.6    o           62    143.6    o
      -17      1.4    o           23     73.4    o           63    145.4    o
      -16      3.2    o           24     75.2    o           64    147.2    o
      -15      5.0    o           25     77.0    o           65    149.0    o
      -14      6.8    o           26     78.8    o           66    150.8    o
      -13      8.6    o           27     80.6    o           67    152.6    o
      -12     10.4    o           28     82.4    o           68    154.4    o
      -11     12.2    o           29     84.2    o           69    156.2    o
      -10     14.0    o           30     86.0    o           70    158.0    o
       -9     15.8    o           31     87.8    o           71    159.8    o
       -8     17.6    o           32     89.6    o           72    161.6    o
       -7     19.4    o           33     91.4    o           73    163.4    o
       -6     21.2    o           34     93.2    o           74    165.2    o
       -5     23.0    o           35     95.0    o           75    167.0    o
       -4     24.8    o           36     96.8    o           76    168.8    o
       -3     26.6    o           37     98.6    o           77    170.6    o
       -2     28.4    o           38    100.4    o           78    172.4    o
       -1     30.2    o           39    102.2    o           79    174.2    o
```

CONSUMER MATHEMATICS
TABLES, CHARTS AND GRAPHS
LESSON: 3L

AIM: How can we use the spreadsheet to construct a statistical table?

PERFORMANCE OBJECTIVES: The student will be able to...

1. Understand why the spreadsheet is such a powerful tool in organizing and analyzing data:
   a) By learning how labels are formatted.
   b) By becoming familiar with the formatting and use of values.
2. Recognize relationships among groups of data and generate lists of numbers using a formula and the replicate command.
3. Experiment with right, left and center (Appleworks) label justification to determine most pleasing format.
4. Use the titles command to freeze column headings and prevent data from scrolling off the screen.
5. Use the built in functions to determine:
   a) Tallies (sum).
   b) Highest and lowest values (Max and Min).
   c) The amount of non zero values present (count).
6. Use the print command to make a hard copy.

VOCABULARY: data, justify, soft copy, hard copy

MOTIVATION:

What is a statistical table?
- How is a statistical table created?
- What special features does the spreadsheet have that will help us create a statistical table?

DEVELOPMENT:

1. Guide students to understand that the spreadsheet is an ideal tool for organizing and analyzing data. Once the

data has been collected it must be entered into the spreadsheet. The data falls into two categories, labels and values. The spreadsheet treats each category differently. The major difference being that arithmetic operations can only be performed on values. The purpose of this section is to catalog the specific utilities that the spreadsheet provides for working with each category listed above.

a) LABELS

- Appleworks:
  - A1. Labels can be arranged in ascending or descending alphabetical order.
  - A2. Labels can be right, left and center justified.
  - A3. Labels can be copied or moved to any available section of the worksheet.
- VisiCalc:
  - V1. VisiCalc does not sort.
  - V2. Right and left justification available, no center.
  - V3. Same as A3.

b) VALUES

- Arithmetic operations such as +,-,*,/, and exponentation on both positive and negative real numbers.
- Built in functions such as Average, Sum, Square root, Count, Maximum value, and Minimum value.
- The use of user defined formulas on the values entered with the ability to replicate these formulas.
- Values can be copied and moved to any available section of the worksheet.
- Values can be displayed rounded to the nearest integer or hundredth.

IN ADDITION:

- Appleworks:
  - A1. Sorts values in either ascending or descending numerical order.
  - A2. Provides for numbers rounded to any fixed

number of decimal places less than 10, as well as including the "$", "%", or "," into a value format.

- VisiCalc:

V1. Can left justify values.

V2. Contains the value of Pi, all trigonometric functions as well as their inverses, all logarithmic functions for both natural and base 10 as well as their inverses.

V3. Contains a graphing option that will change an integer into a set of stars.

2. Offer students the following data on Halley's comet during the month of June 1986. These readings are accurate at 35 degrees North latitude. New York is at approximately 41 degrees North latitude. The rising and setting times are given for a 24 hour clock and are represented in hours and minutes. The altitude of the comet is calculated above the horizon.

Have students enter the following data:

```
HALLEY'S COMET RISING AND SETTING TIMES

JUNE     RISES    SETS     ALTITUDE
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
        1    12.10    23.30        30
        6    11.40    23.10        26
       11    11.20    22.50        23
       16    11.10    22.40        19
       21    10.50    22.20        15
       26    10.30    22.00        12
       30    10.20    21.50         9
```

a) The column headings are to be entered first.

b) We chose the exclamation point as a divider, we felt, for a keystroke, it most closely resembled the appearance of the comet.
Position the cursor in A2.

- Appleworks: Enter the " keystroke that will permit the entry of the exclamation point as a label and hold the "!" until four columns have been filled.
- VisiCalc: (/-, !, Return), will fill one cell. This may be repeated three times, once in each cell

B2.C2.D2, or replicated by positioning the cursor in A2 and entering (/R, Return, B2.D2, Return).

c) The comet readings are given at 5 day intervals. We want to write a formula that will generate these dates for us. Enter a 1 in A3 and notice that each successive date is 5 more than the one before it. Agree to use the formula 5 + A3. Position the cursor in A4 and enter +A3+5 or 5+A3 or (A3+5), be careful not to enter an A as the first entry. The spreadsheet will think that you are entering a label and not a value. If this happens, you will see the A appear in the cell and the word label on the cell indicator line. Pressing the escape key will eliminate the entry. Generate the A column by pressing Return after the formula has been entered to force the cursor to remain in cell A3.
   - Appleworks: (Open Apple-C, Return, Return, ↓, Period, ↓ to A9, Return, →, Return)
   - VisiCalc: (/R, Return, A5.A9, Return, R)

   We have a minor adjustment to make before we can go on. There are only 30 days in June. Change the contents of A9 to 30 from 31.

d) Position the cursor in D3 and enter the altitudes down the D column.

e) The rising and setting times are next. Remind students that when 12.10 is entered, the sheet will display 12.1, since trailing zeros to the right of the decimal point are not displayed. Enter these values in the following manner:
   - Appleworks: First enter the data in both columns and then use the Layout command to achieve the proper formatting. After the data has been entered in both columns position the cursor in column C and (Open Apple-L, →, →, Return, →, Return, Return, Return, 2, Return).
   - VisiCalc: We are only interested in a local format for columns B and C. VisiCalc does not have an option that lets us format by rows or columns. We are only permitted to format by

entry, or in the case of the global command, the entire sheet. If you format blank cells and then replicate this format down columns or across rows you can force the entry of data to be exactly as you choose. We are interested in two fixed decimal places in columns B and C from row 3 through row 9. Position the cursor in B3 and enter (/F$, /R, Return, B4.B9, Return, /R, ↓ to B9, Return, B3.C3, Return). Enter the data into these two columns, all entries will be formatted with two decimal places.

3. The soft copy should now resemble the sample printed in section 2. Have students criticize the appearance of the sample. Use the phrase "hard copy" when referring to the printed sample and the phrase "soft copy" when referring to the video display. The following conclusions should be drawn.
   a) All numbers are neatly displayed and easy to read. Decimal points are aligned and spacing is adequate.
   b) The Title is not centered.
   c) The column headings are left justified causing confusion as to the assigned data.
   d) It is obvious that care was taken when planning value formats but label formats have been neglected. Agree to right justify column headings. Position the cursor in row one.
   - Appleworks: (Open Apple-L, →, Return, Return, →, Return, →, Return)
   - VisiCalc: (/GFR) We have called for a global change even though we are only concerned with row 1. An analysis of the sheet reveals that all the values are right justified. The only cells that are left justified are the one in row 1 that we are concerned with. Calling for this global change can only effect row 1.

4. Have students make a hard copy of their worksheet.
   - Appleworks: (Open Apple-P, Return, Return, Return, Return)

- VisiCalc: (/PP, -, ", HALLEY'S COMET RISING AND SETTING TIMES, ^R^R, Return, D9, Return) See Corrected Sheet Below.

5. Return to the spreadsheet. Experiment with the various ways of clearing the worksheet. If the Blank Command is used or if data is loaded onto existing data, formatted rows and columns remain fixed. Students must be impressed with the necessity to clear the worksheet.
   - Appleworks: Enter the escape key and return to the main menu. Select option 4 and remove the comet file from the desk top. Select option 1, the add files menu and load the file that contains the student names, class and test scores.
   - VisiCalc: (/CY) will clear the worksheet. (/SL, MATHCLS, Return)

   The next section is best understood if students work with a file that is larger than a page. The one we offer in the sample can be entered by one person and copied onto the student's disks. It can be entered during a lab session or given as an exercise to develop skill in data entry and cursor movement.

```
HALLEY'S COMET RISING AND SETTING TIMES

JUNE 1986    RISES     SETS ALTITUDE
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
        1    12.10    23.30       30
        6    11.40    23.10       26
       11    11.20    22.50       23
       16    11.10    22.40       19
       21    10.50    22.20       15
       26    10.30    22.00       12
       30    10.20    21.50        9
```

SAMPLE WORKSHEET

CONSUMER MATH GRADES

A	B	C	D	E	F	G	H	I
OFF.CLASS	NAME	TEST1	TEST2	TEST3	TEST4	TEST5	FI-EX	MINIMUM
712	JIll	74	93	65	98	73	100	65
706	STEVEN	78	100	97	105	105	96	78
717	HOWARD	101	96	90	105	94	88	88
701	NINA	90	82	65	75		82	0
713	SCOTT	96	100	96	110	104	100	96
714	DAVID	93	100	82	85	79	91	79
518	HENRY	105	95	70	98		96	0
713	BETTY	84	91	79	75	91	92	75
508	RICHARD	75	76	80	95	86	91	75
713	TRACY	88	99	78	80		87	0
713	JULIE	71	94	65	62	65	81	62
701	LAUREN	81	89	75	75		100	0
504	TRACY	101	88	95	104	103	89	88
709	LEV	86	82	91	99	80	97	80
716	GLENN	98	94	96	110	94	100	94
515	SARAH	102	100	79	90	100	91	79
701	WAI FONG	91	76	69	85	88	88	69
710	ANGELO			75	90	70	96	0
704	STEVE	86	94	94	95	100	100	86
716	DANNY	73	82	79	70		95	0
720	GORDON	101	91	100	107	96	100	91
708	LAURA		83	81	71	82	80	0
715	MARC	97	98	80	75	88	100	75
713	ALAN	91	94	78	75	95	97	75
707	DAVID	65	90	55	70	20	86	20
708	VIRGINIA	76	87	47	98	88	95	47
708	BENJAMIN	100	94	102	105	80	100	80
715	DUKE	98	99	100	105		100	0
703	IRENE	95	100	77	105	105	100	77
717	ERIC	100	100	91	75	91	96	75
708	NOAH	98	100	84	80	81	99	80
712	SUZANNE	89	89	95	90	92	100	89
712	SABRINA	100	100	94	73	105	100	73

6. When the Grade sheet has been loaded into the computers, ask the following questions.
   - What was Sarah's lowest grade?
   - How many tests did Duke miss?
   - What was the highest grade on Test1?

   a) Lead students to express frustration with data that scrolls off the screen. Remind them of the Title Command that fixes given rows and columns. Have them suggest making the name column stationary. Point out that column B cannot be fixed without fixing column A as well. When fixing columns at the left of the screen:
   - Appleworks: Position the cursor in column C. When fixing left columns we position the cursor in the first column of the non-fixed region. Access the Title command with Open Apple-T. Arrow the cursor once with the right arrow to select left side. The top option will be used later in the lesson to fix the test numbers. The both option fixes top as well as left side. Press Return.
   - VisiCalc: Position the cursor in the B column. When fixing left columns we position the cursor in the last column of the fixed region. Access the Title Command with "/TV". The "T" accesses the command and the "V" accesses the vertical option. When fixing left columns we do so with an imaginary vertical boundary. Have students attempt to scroll the data in columns A and B out of view. The data will pass behind the columns and they will never scroll off the screen. When they are approached with the cursor the program will beep at any attempt to enter the new boundary.

   b) Have students clear the Titles.
   - Appleworks: (Open Apple-T, Return) The second time the Title Command is accessed we only have the option of clearing the Titles.
   - VisiCalc: (/TN)

   c) Return student attention to the Test numbers and agree to fix row 1.

- Appleworks: (Position the cursor in row 2. Open Apple-T, Return)
- VisiCalc: (Position the cursor in row 1, enter /TH) Move cursor freely around sheet until students are convinced that Titles are fixed. Clear Titles with the No option.

d) Have students use the both option to fix row 1 and columns A and B at the same time.

- Appleworks: (Position the cursor in cell C2. This is the upper leftmost corner of the non fixed region. Open Apple-T, →, →, Return) to select the Both option.
- VisiCalc: (Position the cursor in cell B1. This is the lower right cell of the fixed area. /TB)

APPLICATIONS:

1. Remind students that much of the spreadsheet's power comes from the built in functions. With the Grade file still loaded into the spreadsheet have students experiment with some of these functions.

a) Position the cursor in I2 and find the minimum grade that Jill received. Enter@MIN(C2.H2), Return. Replicate this down column I thus finding the minimum grade for all students. Make sure cursor is positioned in I2.

- Appleworks: (Open Apple-C, Return, Return, ↓, Period, ↓ to row 34, Return, →, Return, →, Return)
- VisiCalc: (/R, Return, I3.I34, Return, R, R) Notice that empty cells are assigned zero. Nina's minimum grade is zero (VisiCalc), not because she received a zero on the test, but because she missed a test.

b) Place the maximum grade in column J. Position the cursor in J2. Enter@MAX(C2.H2), Return. Replicate down column J as described in part a.

c) Find the number of tests that each student took. Position the cursor in K2 and enter@Count(C2.H2), Return. This function counts non zero entries. After replicating this function down column K students can check the number of tests missed by each student.

d) Save the worksheet. We will recall it in the next lesson when we continue our statistical analysis.

- Appleworks: (Open Apple-S)
- VisiCalc: (/SS, MATHCLS, Return)

2. Offer class another set of data on Halley's Comet.
   a) Review with the class the:
      - Method of entering the delineator.
      - Formula to generate the dates.
      - Formatting of the rising and setting times.
      - Formatting of the column headings.
   b) Agree to fix headings in rows one and two as well as column A. Elicit the position of the cursor and the correct option to use with the Title Command.
   - Appleworks: (Position the cursor in cell B3, enter Open Apple-T, →, →, Return)
   - VisiCalc: (Position the cursor in cell A2, enter /TB)

Suggested Data:

HALLEY'S COMET RISING AND SETTING TIMES

```
 MAY 1986    RISES     SETS ALTITUDE
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
        1    15.15    01.30       36
        6    14.20    01.10       40
       11    13.50    00.45       40
       16    13.20    00.30       39
       21    13.00    00.10       37
       26    12.30    23.50       34
       31    12.10    23.30       31
```

SUMMARY:

1. What are the different types of data that the spreadsheet utilizes?

2. Can values be entered as labels? (Yes if prefaced with the " keystroke.)

3. What is the major disadvantage of entering values as labels? (The program cannot perform arithmetic operations on values.)

4. What are some of the programs built in functions?
5. Can row 3 be fixed without fixing rows 1 and 2?
6. Can both columns and rows be fixed at once?
7. Where must the cursor be positioned when fixing columns?
8. What value does the program assign to a blank cell?
9. Does the blank command erase the formatting of a cell? (No it erases the data only.)
10. Where can I find a soft copy of my worksheet?
11. How can I create a hard copy of my worksheet?

HOMEWORK:

1. Describe how you would enter the following October dates. 1,4,7,10,13,...,31
2. Explain the quickest way that the years 1950, 1955, 1960,...,2000, can be entered in row 1.
3. In what cell must the cursor be positioned to fix titles in:
   a) Rows 1,2 and 3.
   b) Columns A and B.
   c) Row 1 and column A.
   d) Row 1,2,3, and 4 as well as columns A, B, C, D, and E.
4. Complete the following chart:
   a) Enter the Sum of Columns A through E in Column F.
   b) Enter the Max of Columns A through E in Column G.
   c) Enter the Min of Columns A through E in Column H.
   d) Enter the Count of Columns A through E in Column I.

TEST 1	TEST 2	TEST 3	TEST 4	TEST 5	SUM	MAX	MIN	COUNT
93	65		73	100				
100	97	105	105	96				
82		75		82				
100	82	85	79	91				
	70	98		96				
76	80	95	86	91				

HOMEWORK SOLUTIONS:

1. Enter a 1 in A1. Position the cursor in A2, enter 3+A2, Return. Replicate down column A to row 11.
2. Enter 1950 in A1. Position the cursor in B1 and enter 5+A1, Return. Replicate this formula across row 1 to column K.
3. Appleworks:
   a) Row 4
   b) Column C
   c) B2
   d) F5

   VisiCalc:
   a) Row 3
   b) Column B
   c) A1
   d) E4

Completed Chart:

TEST 1	TEST 2	TEST 3	TEST 4	TEST 5	SUM	MAX	MIN	COUNT
93	65		73	100	331	100	0	4
100	97	105	105	96	503	105	96	5
82		75		82	239	82	0	3
100	82	85	79	91	437	100	79	5
	70	98		96	264	98	0	3
76	80	95	86	91	428	95	76	5
89	75	75		100	339	100	0	4

CONSUMER MATHEMATICS

TABLES, CHARTS AND GRAPHS

LESSON: 4L

AIM: How does the electronic spreadsheet calculate the mean and the median?

PERFORMANCE OBJECTIVES: The student will be able to...

1. Use the built in average function to calculate the mean of a group of values.
2. Enter several groups of data, each containing a different amount of numbers, and use the replicate command to calculate all averages.
3. Change some of the data numbers and see how the automatic recalculation changes the average.
4. Use the recalculation option of the global command to change to manual calculation.
5. Understand why recalculation no longer occurs when data is changed.
6. Use the numerical order option of the arrange command (APPLEWORKS) to sort the numbers.
7. Determine the median of the sorted list.

VOCABULARY: mean, median, deviation, recalculation, frequency, manual

MOTIVATION:

The average grade of a group of ten students is 50%. What are some of the possibilities that could have occurred to yield this average grade?

- Is it possible to have scored a grade one point higher than the class average and find that your grade is among the bottom half of the class?
- Is it possible for a class to have a failing average in a test where half the class received 100 and no one had a grade lower than 20?

DEVELOPMENT:

1. Lead students in a discussion of the significance of an average. From the motivation conclude that to have an average of 50:
   a) All ten students could have scored 50.
   b) Five could have had 0, and five could have had 100.
   c) The grades could have been 0, 10, 20, 30, 40, 60, 70, 80, 90, 100.
   - Similarly a class could have a failing test average of 60 when seven students received a grade of 100 and the other seven received a grade of 20.
   - Conclude that if we want to draw valid conclusions about the way a class performed on a given test we may need to know more than the average.
   - Ask the class what other statistics would aid us in formulating valid conclusions. Elicit that knowing the median would be helpful. Define median, for a group of odd numbers listed in numerical order, as the middle number. If there are an even amount of numbers, listed in numerical order, then take the median to be the average of the middle two.
   - Remind students that as soon as they learn their grade on a current test, they generally become interested in what grade their friend received. They want to know if their grade is like the other grades or if theirs was the highest in the class, or maybe the lowest. Tell students that what they are really asking is how their grade compares with the class average.
   - Ask students how they think the spreadsheet can be used to find statistical information about their tests and their grades? Conclude the following:
   a) The built in average function can be used to find the average of each student's test grades. It can also be used to find the average class grade for each test.
   b) Each student's grade can then be compared with the class average. We will call the difference of these two grades the deviation.

c) The grades can be sorted, (APPLEWORKS ONLY) counted, and the median found.

2. Tell students that they can begin such an analysis by recalling the MATHCLS file they created in an earlier lesson.
   - Appleworks: Access the main menu and press return twice to see a catalog of the files on the current disk. Arrow down to the MATHCLS file and press Return. The file will be loaded into the spreadsheet.
   - VisiCalc: (/SL, MATHCLS, RETURN)

   a) To find the average of Test1, Test2, etc. Position the cursor in C36 and enter:
   - Appleworks: @AVG(C3.C35), Return, Open Apple-C, Return, Return, →, Period, → to Final Exam, Return, →, Return, →, Return.) Have class agree to round average to nearest integer. (Open Apple-L, →, Return, Return, Return, Return, Return.)
   - VisiCalc: We want to find the average and then round it to the nearest integer. We do the formatting before the replicating to avoid having to format each entry individually. @AVERAGE(C3.C35), RETURN, /FI, /R, RETURN, →, Period, → to final exam, Return, R, R). Point out to class that the spreadsheet will ignore blank cells when taking averages. Even though a zero is assigned to all blank cells this zero does not effect the average. This very powerful feature of the spreadsheet enables us to replicate averages even though the data varies from test to test.

   b) Shorten the worksheet to three tests by deleting the other columns. Position the cursor in column F.
   - Appleworks: (Open Apple-D, →, Return, →, →, Return)
   - VisiCalc: (/DC) until all remaining columns have been deleted.

   c) Next we will insert a column after each test. This column will contain each student's deviation from the test average, the figure that appears in row 36. Explain to students that if the student grade is below the test average the deviation will be prefaced by a negative sign. We will read a -7 as seven points below the class average. Position the cursor in column D:

- Appleworks: (Open Apple-I, →, Return, 1, Return)
- VisiCalc: (/IC)

Position the cursor in column F and repeat the above procedure to insert a column and find the deviations for test 2. Enter the column heading DEVIATION in columns D, F, H.

d) To find the deviation position the cursor in D3. Enter +C3-C36, Return. Prepare class to replicate this down column D. Point out that the variable C3 will change with each formula as we are interested in how each student's grade compares with the average. The variable C36 is the average and this will NOT change. In this formula we choose Relative change for the first variable and No change for the second.

- Appleworks: (Open Apple-C, Return, Return, ↓, Period, ↓ to D35, Return, →, Return, Return)
- VisiCalc: (/R, Return, ↓, Period, ↓ to D35, Return, R, N)

Repeat this procedure in column F with the formula +E3-E36 and in column H with the formula +G3-G36 to complete columns F and H. Agree to eliminate the decimal places with a value format of 0 decimal places. This formatting makes the sheet easier to read. Position the cursor in D3:

- Appleworks: (Open Apple-L, →, →, Return, Return, Return, Return, Return, Return, Return)
- VisiCalc: This is best accomplished before the replicate command is executed. (/FI, /R, Return, ↓, Period, ↓ to D35, Return, R, N)

e) Complete the sheet by finding the average of each students grades. Position the cursor in I3:

- Appleworks: @AVG(C3,E3,G3), Return) Replicate down column I as described above.
- VisiCalc: (@AVERAGE(C3,E3,G3), Return) Replicate down column I as described above.

```
         COMPLETED WORKSHEET

                    COMPARISON OF TEST SCORES WITH AVERAGE GRADES

OFF.CLASS     NAME TEST1 DEVIATION TEST2 DEVIATION TEST3 DEVIATION AVERAGE DEVIATION
$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$

      712     JIll    74       -16    93         1    65       -17   77.33        -8
      706   STEVEN    78       -12   100         8    97        15   91.67         6
      717   HOWARD   101        11    96         4    90         8   95.67        10
      701     NINA    90         0    82       -10    65       -17   79.00        -6
      713    SCOTT    96         6   100         8    96        14   97.33        12
      714    DAVID    93         3   100         8    82         0   91.67         6
      518    HENRY   105        15    95         3    70       -12   90.00         5
      713    BETTY    84        -6    91        -1    79        -3   84.67        -1
      508  RICHARD    75       -15    76       -16    80        -2   77.00        -8
      713    TRACY    88        -2    99         7    78        -4   88.33         3
      713    JULIE    71       -19    94         2    65       -17   76.67        -9
      701   LAUREN    81        -9    89        -3    75        -7   81.67        -4
      504    TRACY   101        11    88        -4    95        13   94.67         9
      709      LEV    86        -4    82       -10    91         9   86.33         1
      716    GLENN    98         8    94         2    96        14   96.00        11
      515    SARAH   102        12   100         8    79        -3   93.67         8
      701 WAI FONG    91         1    76       -16    69       -13   78.67        -7
      710   ANGELO             -90             -92    75        -7   25.00       -60
      704    STEVE    86        -4    94         2    94        12   91.33         6
      716    DANNY    73       -17    82       -10    79        -3   78.00        -7
      720   GORDON   101        11    91        -1   100        18   97.33        12
      708    LAURA             -90    83        -9    81        -1   54.67       -31
      715     MARC    97         7    98         6    80        -2   91.67         6
      713     ALAN    91         1    94         2    78        -4   87.67         2
      707    DAVID    65       -25    90        -2    55       -27   70.00       -15
      708 VIRGINIA    76       -14    87        -5    47       -35   70.00       -15
      708 BENJAMIN   100        10    94         2   102        20   98.67        13
      715     DUKE    98         8    99         7   100        18   99.00        14
      703    IRENE    95         5   100         8    77        -5   90.67         5
      717     ERIC   100        10   100         8    91         9   97.00        12
      708     NOAH    98         8   100         8    84         2   94.00         9
      712  SUZANNE    89        -1    89        -3    95        13   91.00         6
      712  SABRINA   100        10   100         8    94        12   98.00        13
                      90              92              82                85
```

3. Offer students the following list of data. Have students enter TEST1 and TEST2. Enter the delineator on the bottom and find the mean for both tests.
   - Appleworks: Prepare to find the median by placing the grades in Test1 in numerical order. Position the cursor in cell C1. Access the arrange command with Open Apple-A. As you highlight down column C the program remembers what column has to be sorted. Press return when you arrive in the cell before the delineator and choose the numerical order option from 0 to 9. The median can then be found by inspection or the class can develop a formula. @ Count(D1.D27)/2 will yield the middle number. If there is an odd amount of numbers the formula will result in a fraction such as 12.5. In this case round the number to the nearest integer, 13, and find the thirteenth number. If there is an even amount of numbers your answer will be a whole number such as 13. In tht case take the average of the thirteenth and fourteenth numbers. Place the median in the row beneath the mean. Repeat the procedure for test 2. When this is complete, rearrange the names in alphabetical order by choosing the alphabetical option of the arrange command.
     VisiCalc: Sorting not available.

COMPLETED WORKSHEET

CLASS ARRANGED IN ALPHABETICAL ORDER

Adam	5K	89	97	1
Alan	5S	90	95	2
Alejandro	5Z	86	91	3
Anna	5Y	69	75	4
Bradley	3L		95	5
Crystal	5X	84	90	6
Daniele	3G	80	90	7
Daphne	5V	82	94	8
David	5F	82	94	9
Dean	5Z	71	88	10
Doreen	5Z	87	96	11
Ed	7W	100	99	12
Edward	3K	84	92	13
Elaine	5F	84	94	14
Erol	5L	85	95	15
Gregory	5C	87	96	16
Ig	5Z	80	85	17
James	5H		91	18
Jin Sung	5V	92	99	19
Kirk	5Z	67	80	20
Linda	5C	94	97	21
Marc	7V	67	80	22
Minchul	5E	80	90	23
Richard	5W	83	94	24
Scott	5E	91	91	25
Sohnia	3L	84	92	26
Winnie	5Q	86	96	27
------------------------				28
MEAN		83.36	91.70370	29
MEDIAN		84	94	30

MEDIAN OF TEST 2 NUMBERS SORTED

ANNA	5Y	69	75	1
Kirk	5Z	67	80	2
Marc	7V	67	80	3
Ig	5Z	80	85	4
Dean	5Z	71	88	5
Crystal	5X	84	90	6
Daniele	3G	80	90	7
Minchul	5E	80	90	8
Alejandro	5Z	86	91	9
James	5H		91	10
Scott	5E	91	91	11
Edward	3K	84	92	12
Sohnia	3L	84	92	13
Daphne	5V	82	94	14
David	5F	82	94	15
Elaine	5F	84	94	16
Richard	5W	83	94	17
Alan	5S	90	95	18
Bradley	3L		95	19
Erol	5L	85	95	20
Doreen	5Z	87	96	21
Gregory	5C	87	96	22
Winnie	5Q	86	96	23
Adam	5K	89	97	24
Linda	5C	94	97	25
Ed	7W	100	99	26
Jin Sung	5V	92	99	27
------------------------				28
MEAN		89.71428	91.70370	29
MEDIAN		84	94	30

```
MEDIAN OF TEST 1
NUMBER SORTED

James        5H          91    1
Bradley      3L          95    2
Kirk         5Z    67    80    3
Marc         7V    67    80    4
Anna         5Y    69    75    5
Dean         5Z    71    88    6
Ig           5Z    80    85    7
Danielle     3G    80    90    8
Minchul      5E    80    90    9
Daphne       5V    82    94   10
David        5F    82    94   11
Richard      5W    83    94   12
Crystal      5X    84    90   13
Edward       3K    84    92   14
Sohnia       3L    84    92   15
Elaine       5F    84    94   16
Erol         5L    85    95   17
Alejandro    5Z    86    91   18
Winnie       5Q    86    96   19
Doreen       5Z    87    96   20
Gregory      5C    87    96   21
Adam         5K    89    97   22
Alan         5S    90    95   23
Scott        5E    91    91   24
Jin Sung     5V    92    99   25
Linda        5C    94    97   26
Ed           7W   100    99   27
------------------------   28
MEAN   89.72727 92.09523   29
MEDIAN        84       94   30
```

4. Position the cursor over the 96 in cell D20. Ask students what will happen to the average if you change the entry from a 96 to a 66. Hopefully they will tell you that the average will change due to the default recalculation of the spreadsheet. After making the change the average will correct itself and become 90.59259.

Students may express surprise at the length of time that this process takes. Appleworks' users can see the message " calculating column A" etc. Remind the class that every time one bit of data is changed or moved, the program examines and recalculates every cell. The order of recalculation can also be readily seen as the program causes the columns to ripple in a downward fashion. When the spreadsheet is large this can take a significant amount of time. One way of avoiding the wait as the spreadsheet recalculates is to turn the recalculation off. Simply change from automatic recalculation to manual recalculation.

- Appleworks: Access the standard values command and change the frequency of the recalculation process to manual. (Open Apple-V, ➤, ➤, ➤, ➤, Return, ➤, Return, ➤, Return)
- VisiCalc: Access the recalculation option of the global command and choose manual. (/GRM)

Now the program will not recalculate until you force a recalculation. Changing the 66 in D20 back to 96 will not change the average. Whenever you are ready for recalculation enter:

- Appleworks: (Open Apple-K)
- VisiCalc: (!)

This will force a recalculation but will not return the spreadsheet to the automatic recalculation mode. Have students change several values at various positions in the sheet before forcing the recalculation. To return to automatic:

- Appleworks: (Open Apple-V, ➤, ➤, ➤, ➤, Return, ➤, Return, Return)
- VisiCalc: (/GRA)

APPLICATIONS:

1. While the class is experimenting with recalculation some teachers might want to explore the Order option. This option changes the order in which the program calculates. The default is down column first. Appleworks users can see the spreadsheet calculation down columns in automatic

recalculation. If the Order option is chosen and Rows specified then recalculation occurs across rows first.

2. Recall the MATHCLS file. Delete Tests 1, 2, and 3. Find the averages of Test 4 and 5, as well as the final exam. Insert columns, as we did in the development and find each student's deviation from the class mean for each test. Find each students test average.

SUMMARY:

1. What built in function is used to find the mean of a group of numbers?
2. What are some of the other functions that are significant when conducting a statistical analysis?
3. Can I find an average of numbers that are not adjacent? That is, can I skip over data that I do not want in my average?
4. Why do I loose my cursor for such a long period ot time when I change one little value?
5. How can I eliminate this problem?
6. What keystroke(s) is used to force the program to recalculate?
7. What is the difference between automatic and manual? Order and frequency?
8. What is the default order in which the program calculates?
9. What command must be accessed before recalculation can be changed?

HOMEWORK:

1. Assume the following set of grades has been entered in column A from row 1 to row 12:
   (98, 76, 89, 82, 100, 93, 65, 69, 76, 79, 80, 71)
   a) Write the formula you would use to find the mean and describe how you would cause the program to place the answer in cell A13.

b) Write the formula that you would use to find the deviation and describe how you would force the program to place all deviations in column B from row 1 to row 12.

c) Describe how you would find the median.

2. Using the data in exercise 1:
   a) Find the mean.
   b) Find each deviation.
   c) Find the median.

3. Consider the following spreadsheet display.

```
==A===B===C===D===E===F===G===H===I===J
  90  78  96  88  82  71  90  99  79
```

   a) Write a formula that can be used to find the average of the grades in cells A1...I1.
   b) Write the formula that will find the average of the grades in cells A1,B1,C1,D1,H1.
   c) Write a formula that will find the average of the grades in every cell except cell F1.

4. Find each average defined in exercise 3.

HOMEWORK SOLUTIONS:

1. a) Position the cursor in cell A13. Enter @AVERAGE(A1.A12).
   b) Position the cursor in B1. Enter +A1-A13, Return, Replicate this formula down column B choosing Relative change for the first variable and No change for the second variable.
   c) Place the numbers in numerical order and find the average of the 6th and 7th grade.

*** APPLEWORKS USERS *** substitute AVG for AVERAGE and use the ARRANGE Command to place the numbers in numerical order.

2.

	GRADE	DEVIATION	MEDIAN	
	98	17	65	
	76	-6	69	
	89	8	71	
	82	1	76	
	100	19	76	
	93	12	79	79.5
	65	-17	80	
	69	-13	82	
	76	-6	89	
	80	-2	93	
	71	-11	98	
AVERAGE →	82		100	

3. a) @AVG(A1.I1)
   b) @AVG(A1.D1,H1)
   c) @AVG(A1.E1,G1.I1)

   *** VisiCalc Users use AVERAGE in place of AVG. ***

4. a) 85.888...
   b) 90.2
   c) 87.75

CONSUMER MATHEMATICS
TABLES, CHARTS, AND GRAPHS
LESSON: 10L

AIM: How can we use the spreadsheet to construct bar graphs and pictographs?

PERFORMANCE OBJECTIVES: The student will be able to...

1. Use the star option of the format command (VisiCalc) to substitute stars for a value in a given cell.
2. Create a horizontal bar graph with a label for each bar.
3. Create a pictograph using the star as the symbol.
4. Construct a pictograph using the repeating label and the replicate command.
5. Experiment with different keystrokes in making the vertical bars.
6. Use the print command to make a hard copy of:
    - a) The horizontal bar graph with a title.
    - b) The pictograph, with a title above and a legend below.
    - c) The vertical bar graph with single spacing.

VOCABULARY: asterisk

Note to Teachers: Only VisiCalc users will be able to access the star option. The lesson is designed to use /F*, and the replicate command. All of the graphs and drawings presented in this lesson can be drawn using the Appleworks spreadsheet. Asterisks can be entered as they would be entered for repeating labels. Using the " keystroke enables any entry to be placed in a cell. This in conjunction with the copy command enables the user to create these charts very quickly.

MOTIVATION:

Have students access a blank worksheet. Direct them to enter the following data in row A. 9,5,6,8,3,1,4,7,2. Next access the star option of the Global Format Command with "/GF*". All numbers on the spreadsheet change to stars. The display at the right shows the original set of numbers next to the asterisk display. We present this for display purpose only. When the star option is accessed the numbers will disappear.

```
9 *********
5 *****
6 ******
8 ********
3 ***
1 *
4 ****
7 *******
2 **
```

DEVELOPMENT:

1. Draw the following conclusions about the resulting display.
   a) "/GF*" will change all values on the sheet into a corresponding list of asterisks.
   b) The first space in the cell will be left blank.
   c) The number of stars will be the same as the value that was in the cell provided that this number was at least one less than the column width. Direct class attention to cell A1. There are 8 stars in A1 and the number we entered was 9. The spreadsheet's default column width is 9. If the column width is changed to 10, the ninth star will appear in the cell. All other cells contain the exact number of stars that were originally specified.
   d) To change only one numeric entry to a set of asterisks it is not necessary to invoke the global command. "/F*" is all that is needed.
   e) Have students experiment with drawing on the sheet that has been globally formatted with the star. Every time a value is entered with the Return or

arrow keys, the entry will change to stars. Create a list of GUIDELINES on the board. Use student input as their experimentation leads them to draw conclusions. One example might be:

- When using the star option the asterisks cannot be right justified.

2. Before students begin drawing graphs let them experiment with their initials, as in the sample at the right.

   a) We created the "E" with (8,8,2,2,2,8,2,2,2,8,8). The "T" cannot be created directly. For the vertical part use the " keystroke, enter four spaces and then 2 stars, then Return. Replicate this from B4 to B11. Enter 8 in B1 and B2 and then "/GF*".

```
********  ********
********  ********
**            **
**            **
**            **
********      **
**            **
**            **
**            **
********      **
********      **
```

   b) Attempt to fill adjacent columns with stars. Enter an 8 in A3, B3 and C3. Due to the fact that the first entry in each cell is left blank the result will not be a continuous line. The display will be:

```
******** ******** ********
```

   Ask students if they think changing column widths would eliminate the unnecessary spaces. Elicit that no matter what the column width is, the first cell will be left blank. Conclude that horizontal bars cannot be made by using adjacent columns.

   c) Elicit the following two rules and add to the GUIDELINES.

      1. First determine the number of stars that are needed for the longest horizontal row to be drawn. Adjust the column width to be one more than that number.
      2. When it is necessary to connect two columns and place a star in the first entry of a cell use the " keystroke and add the stars manually.

d) Point to the need for planning. Suggest the use of graph paper to plan the letters needed. Block letters are attractive when created by spreadsheets. If students are left on their own they will probably amaze you with their imaginative displays. Suggested samples follows:

```
*         ********     ********     ********     ***      ***
**        ********     ********     *******      ***      ***
***       ********     ********     ******       ***      ***
****      ********     ********     *****        ***      ***
*****     ********     ********     ****         ***      ***
****      ********     ********     ***          ***      ***
***       *            **           **           ***      ***
**        **           **           *            ***      ***
*         ***          **           **           ***      ***
**        ****         **           ***          ***      ***
***       *****        **           ****         ***      ***
****      ******       **           *****        ***      ***
*****     *******      **           ******       ***      ***
****      ********     **           *******      ***      ***
***                                 ********     ************
**                                               ************
*
```

e) Letters such as the "U" above are slightly more challenging. First we formatted the sheet with "/GF*." Next we used the following sequence. Enter a 3 in H1 and press Return (/R, Return, H2.H14, Return, /R, ↓ to H14, Return, >, Return). Move the cursor to H15 and enter an 8 in both H15 and H16. Enter "**** in I15 and I16.

3. Initials should be saved for printing at a later time. If time is available and students enjoy this topic the alphabet can be created and saved in a separate file. Once each letter is created the file can be recalled, the letters replicated in any position, in any sequence. This file can be used for writing messages and creating posters.

4. Use the following data to create a pictograph.

Planet	Number of Natural Satellites
EARTH	1
JUPITER	12
MARS	2
MERCURY	0
NEPTUNE	2
PLUTO	0
SATURN	10
URANUS	5
VENUS	0

```
PLANET       NATURAL SATELLITES
///////////////////////////////
EARTH         *
JUPITER       ************
MARS          **
MERCURY
NEPTUNE       **
PLUTO
SATURN        **********
URANUS        *****
VENUS
```

EACH * REPRESENTS ONE NATURAL SATELLITE

Plan the graph:

a) Enter column headings in row 1.

b) Create a delineator with the repeating label.

c) Enter the planet names in column A.

d) Enter the moons in column B.

e) Change column width to 13.

f) Provide for a legend in row 13.

5. Use the following data to create the Vertical Bar Graph depicted below.

Earnmore Company Net Profit Record.

Year	Amount
1980	$40,000
1981	$60,000
1982	$90,000
1983	$140,000
1984	$160,000
1985	$150,000
1986	$190,000

Plan the graph:

a) Change column width to 4.
b) Enter 200 in B1.
c) Generate the amounts with the formula (B1-10) and the replicate command.
d) Generate the grid markings by entering a "- in C1. The " keystroke permits the entry of the minus sign. Replicate this entry down column C.
e) Enter Year in B23 and 19- in D23.
f) Enter an 80 in E23 and generate the years with the formula (E23 + 1) and the replicate command.
g) Use the repeating label for the delineator in row 22.
h) Create the bars by entering a 3 in the appropriate row.
(For example in year 1982 the appropriate row would be 12, as that is the row that contains the entry 90.) As soon as the 3 is entered, position the cursor over the 3 and enter "/F*".
i) Replicate this entry down to row 21.
j) Continue in this manner, entering the 3 in the appropriate row, formatting to stars and then replicating down to row 21.
k) Position the cursor in cell A1 and enter the vertical scale heading one letter at a time.

Students should be permitted to complete the graph, working alone or with their partners at the computer.

```
   EARNMORE COMPANY NET PROFIT RECORD

A     200-
M     190-                             ***
O     180-                             ***
U     170-                             ***
N     160-                     ***     ***
T     150-                     *** *** ***
S     140-                 *** *** *** ***
      130-                 *** *** *** ***
I     120-                 *** *** *** ***
N     110-                 *** *** *** ***
      100-                 *** *** *** ***
1      90-             *** *** *** *** ***
0      80-             *** *** *** *** ***
0      70-             *** *** *** *** ***
0      60-         *** *** *** *** *** ***
       50-         *** *** *** *** *** ***
D      40-     *** *** *** *** *** *** ***
O      30-     *** *** *** *** *** *** ***
L      20-     *** *** *** *** *** *** ***
L      10-     *** *** *** *** *** *** ***
A       0-     *** *** *** *** *** *** ***
R   --------------------------------------
S   YEAR   19-  80  81  82  83  84  85  86
```

6. Make a hard copy of the graph and include a Title.
   - Access the Print command with /PP.
   - Enter the "-" for single spacing and the " for Setup.
   - Enter a few spaces to center the Title.
   - Enter the Title and ^R, to force a carriage return.
   - Enter the lower right coordinates K23 and press Return.

APPLICATIONS:

Have students create the following graphs. Generate the scales with a formula and the replicate command. Years should also be generated with formulas. Print with various styles of print to achieve different effects.

1. Use the following data to create a horizontal bar graph. Numbers of seniors enrolled in various subjects.

COMPUTER SCIENCE	700
ENGLISH	1200
MATHEMATICS	900
SOCIAL STUDIES	600
SCIENCE	1100

```
    SUBJECTS TAKEN BY SENIORS
    --------------------------------------
    COMPUTER SCIENCE   *******
                       *******

S   ENGLISH            *************
U                      *************
B
J   MATHEMATICS        **********
E                      **********
C
T   SOCIAL STUDIES     ******
                       ******

    SCIENCE            ************
                       ************

                       / / / / / /  /  /
                       1 3 5 7 9 11 13 15
                      HUNDREDS OF STUDENTS
```

2. Use the following data to create a vertical bar graph. Number of Lunchtime Hamburgers Purchased by High School Juniors.

1980	20,000
1981	40,000
1982	25,000
1983	35,000
1984	15,000
1985	10,000

```
   HAMBURGERS ORDERED BY JUNIORS

T  H 45-
H  A 40-       ***
O  M 35-       ***     ***
U  B 30-       ***     ***
SO U 25-       *** *** ***
AF R 20-   *** *** *** ***
N  G 15-   *** *** *** *** ***
D  E 10-   *** *** *** *** *** ***
S  R  5-   *** *** *** *** *** ***
   S  0-   *** *** *** *** *** ***
       19-  80  81  82  83  84  85
                 YEAR
```

3. Draw a Pictograph to represent the following data.
   Number of ROBOTS produced in New York City.

2000	300,000
2025	700,000
2050	900,000
2075	1,000,000

```
    ROBOTS PRODUCED IN NEW YORK CITY

YEARS

    2000  (%) (%) (%)
    2025  (%) (%) (%) (%) (%) (%) (%)
    2050  (%) (%) (%) (%) (%) (%) (%) (%) (%)
    2075  (%) (%) (%) (%) (%) (%) (%) (%) (%) (%)

EACH (%) REPRESENTS 100,000 ROBOTS.
```

- Experiment with various combinations of keystrokes to achieve a symbol that best represents a ROBOT. Try "(*)", "(+)", "oRo", " -/", matching the keystrokes with the column width. For example, if 3 keystrokes create the symbol and one character is used for a space then each symbol needs 4 spaces. For even distribution the column width must be planned for a multiple of four. Use the replicate command to complete the needed symbols.

SUMMARY:

1. How can I change all values on the spreadsheet into asterisks?
2. How many asterisks will appear in a cell if the default column width is in effect and the entry in the cell is 10?
3. What will the display be if the column width is changed to six, a six is entered in A1,B1,C1, and "/GF*" is entered?
4. What formula will generate the years 1980, 1985, 1990..., across row 1 if 1975 is entered in A1?

5. How can the worksheet be prepared to produce stars whenever the user finalizes the entry of a value?

6. What procedure must be followed if I wish to avoid formatting each entry in column B with "/F*", when column B is the only column that is to contain stars? (Format the column by replicating the entry "/F*" down the column before the numbers are entered.)

HOMEWORK:

1. Use graph paper to describe how you would enter the word FUN using the spreadsheet and the Asterisk option of the Global Format command. Include the column width and values entered in your answer.

2. Draw a horizontal bar graph to show the following data.

   Population of Getsmart High School.

Ninth Grade	400
Tenth Grade	700
Eleventh Grade	600
Twelfth Grade	500

   Include the formula you would use to generate the horizontal scale.

3. Plan a vertical bar graph to represent the following data.

   Number of Space Travellers.

1990	1000
2005	2000
2020	5000
2035	8500
2050	9900

   a) Write a formula that can be used to create the years.
   b) Write a formula that can be used to generate a scale to represent the number of Travellers. What will be your first entry for this scale?
   c) Describe the column width that you would use and how you would create the vertical bars.

4. Make a pictograph that can be used to represent the following data.

Computers used in Various Fields.

Education	5 Million
Business	15 Million
Publishing	3 Million
Sports	2 Million
Manufacturing	8 Million

HOMEWORK SOLUTIONS:

1.

```
*****  **    **    **    **          5    2    2    2    2
*****  **    **    ***   **          5    2    2    3    2
**     **    **    ****  **          2    2    2    4    2
**     **    **    ***** **          2    2    2    5    2
****   **    **    ********          4    2    2    5   ***
****   **    **    **    **          4    2    2    2    2
**     **    **    **    **          2    2    2    2    2
**     **    **    **    **          2    2    2    2    2
**     ********    **    **          2    5   ***   2    2
**     ********    **    **          2    5   ***   2    2
```

Column width = 6

2. POPULATION OF GETSMART HIGH SCHOOL

```
    NINTH             ****
                      ****
G
R   TENTH             *******
A                     *******
D
E   ELEVENTH          ******
                      ******

    TWELFTH           *****
                      *****
    -------------------------
                    1 3 5 7 9
      HUNDREDS OF STUDENTS
```

3. a) 15+A1
   b) First entry 0, (A7 + 1000)
   c) Use a column width of 4, enter a 3 in the appropriate row and then "/F*", Replicate to end of graph.

4.

COMPUTERS AT WORK

BUSINESS	(T) (T) (T) (T)
EDUCATION	(T) (T) (T) (T) (T) (T) (T) (T) (T) (T) (T) (T) (T) (T) (T)
MANUFACTURING	(T) (T) (T)
PUBLISHING	(T) (T)
SPORTS	(T) (T) (T) (T) (T) (T)

EACH (T) REPRESENTS 1 MILLION COMPUTERS

CONSUMER MATHEMATICS

INDIRECT MEASUREMENT AND TRIGONOMETRY

LESSON: 8L

AIM: How does the electronic spreadsheet measure angles and what are some of its built in trigonometric functions?

PERFORMANCE OBJECTIVES: The student will be able to...

1. Write a formula to find the third angle of a triangle.
2. Use the replicate command to make calculations easier.
3. Understand that the spreadsheet uses radian measure instead of degree measure.
4. Select various lengths for the measure of a triangle's legs and calculate the tangent ratio (column C). VisiCalc users only.
5. Define ATAN(N) as the angle whose tangent is N.
6. Use the built in function ATAN (column C) to approximate the measure of the angle in radians (column D).
7. Approximate the measure of the angle in degrees using the factor 57.297.
8. Use the built in TAN function TAN (column D), in column F.
9. Explain why columns C and F have the same values.
10. Explain why using a spreadsheet eliminates the need to have a trig. table.

VOCABULARY: angle, right angle, triangle, right triangle, ratio, degree, measure, radian measure, tangent, Arctangent (ATAN)

MOTIVATION:

Remind students of the way they created the mini table of tangents in a previous lesson. Ask them how they think the spreadsheet could be used to simplify their labors. Clearly the work of measuring the two legs of the triangle cannot be done by the spreadsheet! Lead them to the conclusion that the spreadsheet will do all the arithmetic for them. If they enter the data that they collect from measuring triangle parts, write formulas and replicate these formulas the spreadsheet will give them the answer to long lists of data in seconds.

DEVELOPMENT:

TEACHERS NOTE: VISICALC CONTAINS THE BUILT IN TRIG FUNCTIONS. SOME TOPICS IN THIS LESSON ARE NOT AVAILABLE TO APPLEWORKS USERS. WE SUGGEST THAT VISICALC USERS SKIP THE FIRST TWO SECTIONS OF THIS DEVELOPMENT.

1. A general review of the following terms should be conducted before this lesson begins. Review the measure of a right angle, the definition of a right triangle. The meaning of the side opposite the angle and the side adjacent to the angle should be reviewed as well. The sum of the measures of the angles of the triangle should be stated. The definition of the tangent function must be reiterated as the ratio of the side opposite an angle to the side adjacent to that angle. Students should be able to verbalize that this ratio exists for right triangles.
2. Tables of trigonometric functions (tangent only) can be generated by the spreadsheet. Have students enter the measure of Angle A in column A and the measure of side a in column B and the measure of side b in column C. Column D should be labeled tangent and the formula that will generate this column be developed by the class (B1/C1). The measurement can be done by committees or rows and then pooled by the group into one large spreadsheet.
3. Have students find the missing angle of any triangle, given two of its angles. Use the suggested table:

Enter the values for Angles A and B in columns A and B respectively. Generate column C with the formula (180-(A2+B2)). Replicate with:

- Appleworks: (Open Apple-C, Return, Return, ↓, Period, ↓ (8 times), Return, →, Return, →, Return)
- VisiCalc: (/R, Return, C3.C11, Return, R, R)

This table can be expanded as time permits.

Angle A	Angle B	Angle C
30	60	90
40	40	100
50	50	80
45	45	90
67	34	79
82	25	73
14	15	151
23	45	121
72	24	84
37	73	70

4. Save the worksheet but do not clear it.

- Appleworks: Open Apple-S
- VisiCalc: (/SS, FINDANGL, RETURN)

Ask students what special property Right triangle, angles have. Make use of their knowledge to generate a new column B. Delete column B by placing the cursor anywhere in column B and accessing the Delete Command.

- Appleworks: (Open Apple-D, → →, Return, Return)
- VisiCalc: (/DC)

Enter the label Angle B again and write a new formula to generate the second acute angle of the right triangle (90-A2). Replicate this formula down column B in the same manner as column C was previously generated. This time as the sheet recalulates all the angles in column C will change to 90.

Angle A	Angle B	Angle C
30	60	90
40	50	90
50	40	90
45	45	90
67	23	90
82	8	90
14	76	90
23	67	90
72	18	90
37	53	90

Altered Worksheet

THE FOLLOWING SECTIONS ARE FOR VISICALC ONLY.

5. We are going to make use of VisiCalc's built in trigonometric functions. Before we can begin there are three very important points that we must understand:
   a) VisiCalc does not measure an angle in degrees. The unit of measure that VisiCalc uses is the Radian. We

have, in the past, learned that some people use yards to measure while other use meters. This is the same kind of difference. Whenever we wish to change the radian measure that VisiCalc offers to degrees we will simply multiply by the factor 57.297.

b) VisiCalc has a built in tangent function. This built in function is of the same type as SUM, MAX and AVERAGE. It is accessed the the @key and answers with great accuracy. Because VisiCalc uses radian measure we cannot ask it for the TAN(30) if we mean 30 degrees. The number that is placed inside the parentheses must be the measure of an angle IN RADIANS.

c) If you tell VisiCalc the number that is the tangent of an angle, the spreadsheet will give you the measure of that angle (in radians). In Mathematics we call this the Arctangent. VisiCalc calls this ATAN and we use this built in function to find an angle, when we know its tangent. Teacher might want to write a short definition on the board. @ATAN(#) is the angle whose tangent is represented by the number inside the parentheses.

6. Generate the table depicted in section 6h in the following manner.
   a) Enter the labels in row 1 and 2.
   b) Use the Repeating Label and Replicate Commands to generate the delineator (/-, -, Return, /R, Return, B3.F3, Return).
   c) Enter the data that represents the length of the legs a and b in columns A and B respectively.
   d) Write a formula to generate the tangent ratio in column C (A4/B4). Position the cursor over C4, enter the formula and press Return. Replicate with (/R, Return, C5.C9, Return, R, R).
   e) Find the measure of Angle A in radians using the built in ATAN() function. Position the cursor in D4 and enter @ATAN(C4), Return. Replicate with (/R, Return, D5.D9, Return, R). Remind students that they are not used to seeing radian measure and converting to degrees will be more meaningful.

f) Write the formula D4*57.297. Position the cursor over E4, enter +D4*57.297, Return. Round to the nearest degree with the format command before this formula is replicated so that the rounding will be replicated as well (/FI). The teacher might want to check this value with the trigonometric table to emphasize the value of using the spreadsheet. Replicate down the row with (/R, Return, E5.E9, Return, R).

g) Now take the tangent of this angle and prove that our calculations were correct or that the spreadsheet calculated correctly. Position the cursor over F4 and enter@TAN(D4), Return. Replicate with (/R, Return, F4.F8, Return, R).

h) Completed sheet:

RIGHT----TRIANGLE SIDE A	 SIDE B	TANGENT RATIO	ANGLE A RADIANS	ANGLE A DEGREES	TANGENT RATIO
7	10	.7	.6107260	35	.7000000
6	5	1.2	.8760581	50	1.200000
2	3	.6666667	.5880026	34	.6666667
2	2	1	.7853982	45	1.
8	8	1	.7853982	45	1.
8	15	.5333333	.4899573	28	.5333333

APPLICATIONS:

1. The procedure outlined in section 6 of the development can be immediately reinforced by clearing the worksheet and entering a new set of data. A new table can be constructed following the pattern set by the previous table. Use the data at the right and generate the suggested table below.

RIGHT----TRIANGLE SIDE A	 SIDE B
7	7
6	12
1	3
2	5
8	11
11	13

RIGHT----TRIANGLE		TANGENT	ANGLE A	ANGLE A	TANGENT
SIDE A	SIDE B	RATIO	RADIANS	DEGREES	RATIO
7	7	1	.7853982	45	1.
6	12	.5	.4636476	27	.5000000
1	3	.3333333	.3217506	18	.3333333
2	5	.4	.3805064	22	.4000000
8	11	.7272727	.6287963	36	.7272727
11	13	.8461538	.7022569	40	.8461538

2. Generate a table of radians and degree equivalents. Use tenths of radians. Begin with .1 and end with 6.3 or 6.5. Formulas can be written to generate both these columns. Enter .1 in A1, Position the cursor in A2 and enter +A1+.1, Return. Replicate this formula to the desired limit. Write a formula to generate the degree column. Use (A1*57.297).

- Appleworks: This column can be rounded to 2,3, or 4 decimal places using the fixed option of the Layout Command. If this is done before the formula is replicated then each cell will be rounded as it is generated. Appleworks provides for formatting by rows, columns, or entries. By choosing the column option of the layout command, formatting individually is never necessary.
- VisiCalc: Unless you use the dollar option or the integer option of the format command VisiCalc does not offer a way of rounding numbers. Column width can be changed but this must be done globally and therefore other columns will suffer. The best way to create this sheet with VisiCale is to round to the nearest hundredth with the dollar option or not to attempt to round the degree measure.

3. Find the third angle of a triangle, given two angles and the formula 180-(A1+B1).

```
 ===A======B======C===
 1      26      62
 2      15      78
 3      33      56
 4      24      35
 5      47      64
 6      61      44
 7      52      17
 8      98      21
 9      89      83
 10     70      70
```

SUMMARY:

1. Is the degree the only way to measure angles?
2. What is larger, one degree or one radian?
3. In what way is radian measure converted to degree measure?
4. What is the sum of the degree measure of the angles of a triangle?
5. What is the sum of the two acute angles of a right triangle?
6. How does VisiCalc measure angles?
7. How is the tangent ratio determined?
8. Will the tangent of an angle be a different number if the angle is measured in degrees, then if the angle is measured in radians?
9. What command and what option would you choose to round one entry to the nearest hundredth?
10. What command and what option would you use to round all values to the nearest integer?

HOMEWORK:

1. Assume one acute angle of a right triangle is entered in cell U7. Write a formula that can be used to find the other acute angle.

2. Explain how the spreadsheet can be used to generate the first 16 positive multiples of 5 in Column N, after placing a 5 in N1.

3. We learned that to change radian measure to degree measure we multiply the number of radians by the factor 57.297. To convert degrees to radians, divide the degree measure by 57.297. Assume that the multiples of five just generated in answer to question 2 represent degrees. Describe how you would change these 16 degree measures to radian measures and place the answers in column O.

4. (VISICALC ONLY) describe how you would find the tangent of an angle of 5 degrees, 10 degrees, 15 degrees, ..., 80 degrees, and place your answer in column P.

5. (APPLEWORKS ONLY) describe how you would round the radian measure in column O to the nearest tenth of a radian.

6. a) Write a formula that will find the tangent of angle A in column C of the spreadsheet depicted below.
   b) Describe how you would use the spreadsheet to round decimals to the nearest hundredth.
   c) Complete the spreadsheet by finding the tangent of Angle A and round your answer to the nearest hundredth.

```
  ====A========B========C========D====
1 side a   side b   TANGENT(A)
2         34       55
3         42       55
4         47       76
5         51       68
6         68       81
7         77       62
8         83       98
```

HOMEWORK SOLUTIONS:

1. (90-U7)

2. Position the cursor over N2, enter +N1+5, Return.
- Appleworks: (Open Apple-C, Return, Return, ↓, Period, ↓ (13 times), Return, ➤, Return) or access the copy command, choose within worksheet, highlight only the one entry in N2. Begin the target range in N3 and highlight each cell through N16. Finally choose one relative change for the one variable in the formula +N1+5.
- VisiCalc: (/R, Return, N3.N16, Return, R) or access the replicate command with /R, since the cursor is over the source we need only press return. Enter the target range with N3.N16, Return and choose one relative change for the one variable in the formula (N1).

3. Position the cursor in O1. Enter +N1/57.297, Return.
- Appleworks: (Open Apple-C, Return, Return, ↓, Period, ↓ (14 times), Return, ➤, Return). Follow the same description as in answer to question 2. Substitute O2.O16, for target range.
- VisiCalc: (/R, Return, O2.O16, Return, R). Follow the same description as in answer to question 2. Substitute O2.O16, for target range.

4. Position the cursor over P1, enter @TAN(O1). Replicate this down column P.

5. Position the cursor over O1. Access the layout command with Open Apple-L, choose column and highlight only column L. Choose Value format, Fixed decimal and then 1, for the tenth place. Appleworks will automatically round to one decimal place.

6.

```
 ====A========B========C========D====
1 side a   side b   TANGENT(A)
2       34       55       .62
3       42       55       .76
4       47       76       .62
5       51       68       .75
6       68       81       .84
7       77       62      1.24
8       83       98       .85
```

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